RAILROAD GAZETTE

FRIDAY, MARCH 15, 1901.

CONTENTS

ILLUSTRATED:
Two Drawbridges on the New York Central..... 179
Four-Wheel Passenger Truck of the Chicago, Burlington & Quincy 183
The Imperial Combination Hand Car..... 185
The Ward Rail Joint..... 186
Reconstruction on the Union Pacific..... 183
The Robins Conveying Belt..... 192
EDITORIAL:
Telephones in Train Despatching and Other Railroad Work 188
Annual Report—Missouri Pacific 189
Editorial Notes 188, 189
New Publications 189
CONTRIBUTIONS:
From Car Record Office to Yard Master's Office.... 179
MISCELLANEOUS:
The Manibill 179
The Accident-Report Law..... 182
Sundry Civil Appropriations by Congress..... 182
Stocks and Bonds to be Valued by a Commission..... 183
Yards and Terminals 183
Graduation 185
Ballasting 190
Masonry 190
GENERAL NEWS:
Technical 192
The Scrap Heap..... 192
Locomotive Building 192
Car Building 192
Bridge Building 192
Meetings and Announcements..... 193
Personal 193
Elections and Appointments..... 193
Railroad Construction 194
General Railroad News..... 194

Contributions

From Car Record Office to Yardmaster's Office.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The yardmaster's office at an important freight yard is the center at which is concentrated the record of cars arriving and departing, the arrangement of trains, the selection and classification of proper cars and the pushing forward of special freight. Indeed, the yards of a railroad in importance may be compared to the heart of an animal.

This office work in the yards requires quite a high order of clerical ability, considerable general knowledge and a good system of keeping account of the movement of cars in the yards. I venture to suggest, therefore, that clerks who are graduates of high schools, of good ability, from the car record office, used to the methods and short cuts practiced in a large office, be supplied to the yardmaster's office as a high grade help to the yardmaster.

In order to get the best results this change should not be exceptional and spasmodic in specially rare cases, but might be a recognized and settled method of promotion as on some roads from college graduate to supervisor and from supervisor to superintendent. G. M.

The Manibill.

The manibill is not a water bird; neither is it a mongoose; it is merely a waybill, written in manifold, which is now used on the Central of Georgia. The idea is not new, but it is carried out with such completeness as to provide at one writing all the documents necessary in dealing with a shipment of freight, except the bill of lading and the notice to consignee. This last appears to have been omitted for the reason that a written notice is often unnecessary, and where necessary should be sent on a card of smaller size than a waybill or freight bill. If sent by mail such a notice should, of course, be written (and printed) on a postal card. Agents are allowed, however, to make and send out tissue press copies of freight bills.

In any system under which the waybill and the freight bill are made at one writing it is necessary, of course, to use from five to twenty times as much paper for waybills as would be used under the ordinary plan, and the Central of Georgia uses a sheet 8 in. x 7 in. for each entry. Two of these, printed on a sheet 8 in. x 14 in. make as large a paper as it is convenient to handle.

We show herewith a copy, of which the portion in Roman letters is practically a fac simile, of the simplest form of the upper sheet (Freight Transcript or waybill) of a local "manibill." The full sheet is 7 in. in depth and there are seven lines for writing besides an eighth line for the totals. The portion of this bill above the line *a b* contains data not needed on the freight bill and other documents, and the sheets beneath the freight transcript are blank in this part. In the case of the delivery receipt this space affords a margin for binding.

The next sheet below the freight transcript is blank tissue; the next below that is the freight bill, and the fourth and last sheet is the delivery receipt. The receiving agent inserts the "date received" immediately above the space in which is written the word "Savannah." This date appears in the same position on all of the papers. The freight bill number, in like manner, is written below "Savannah." The place for signing the freight bill and noting date of collection is at the lower left hand corner, and the consignee's signature on the delivery receipt is in the same place. The freight transcript is made on yellowish paper, the freight bill on white, and the delivery receipt on pink paper. The bottom of the freight transcript has the following notes:

Prepayment applying beyond Manibill destination shall be entered in the last column and the words "Prepaid Beyond" written above the amount.
Copying full-carbon paper shall be placed between the tissue and freight-bill and record semi-carbon paper between the freight-bill and delivery receipt. The tissue carbon copy shall be retained by forwarding agent.
*When written with Typewriter, the perpendicular line between the date and number may be ignored.
‡This space is for notations which should not appear on freight-bill.

Other particulars concerning the use of the manibill are shown in the circular issued by Mr. Beymer, Freight and Passenger Accountant, as follows:

Forwarding Agents.—All parts shall be made at one writing, the freight transcript with copying pencil or typewriter and copying ribbon, and the other parts by use of carbon paper, inserted as follows: Between the tissue and the freight bill, copying full carbon paper; between freight bill and delivery receipt, record semi-carbon paper. (Full carbon paper is carbonized on both sides; semi-carbon on one side. Copying carbon paper produces copies from which impression copies may be obtained; record carbon does not). The tissue is removed upon completion of the manibill and used for taking an impression record of freight forwarded in a tissue book and as many loose tissue copies as are required. To secure the maximum number of impression copies, cloths should be damper than for taking copies of pen writing; two tissues may be obtained from the face and three from the back of the tissue sheet of the manibill when the copying carbon paper is properly used.

When the weight of a carload shipment is subject to correction the weight and freight are omitted from the *freight bill* in the following manner: After otherwise completing the manibill, a sheet of paper is inserted between the copying carbon paper and the freight bill, and the weight and freight then inserted on the next line below the description of the freight. The agent at destination then inserts on all parts the actual weight and the correct freight on the line with the description of the freight.

Folded lengthwise through the middle, the freight transcript face outward, the three hard paper parts of the manibill, uncopied, are forwarded with the freight. Manibills are separately folded and pinned through top and bottom to prevent mutilation, though for through cars of mixed freight all manibills can be folded together without pinning and delivered to the conductor in an envelope.

To obviate the necessity for rewriting freight bills at destination, care must be exercised in computing and inserting the freight and other charges. Records will be kept of errors in billing which necessitate duplication of labor at destination.

Receiving Agents.—Upon receipt at destination, the parts of the manibill are dated, numbered and revised, and thereafter are accorded the same handling as the corresponding documents of the system heretofore in vogue.

For freight received on interline waybills, manibills are prepared by using a record semi-carbon sheet between the tissue and the freight bill, and between the latter and the delivery receipt. After an impression copy thereof has been taken for record, the freight transcript may be used for a notice of arrival when needed for that purpose; otherwise it is destroyed.

Immediately upon arrival of freight, consignees must be notified in person, by messenger, by telephone, or, none of these means being available, by card, form 540 (two forms, for postal and messenger delivery), the hour and method of which is noted on the record. At the close of the day, postal card notices form 540, are mailed to all consignees of freight remaining on hand who have not already been notified in that manner, except that when labor or postage may be saved thereby, impression copies of freight bills on manila copying paper may be used.

When the revision of a manibill increases the charges, the original freight bill, duly corrected, may be delivered to a connecting carrier, but a freight bill on form 568 for the correct amount must be rendered to a consignee; when the charges are decreased the original corrected freight bill may be used, unless declined by a consignee.

Freight bills for prepaid shipments received must not be signed or stamped "Paid" by agent at destination.

General.—Tissue copies from documents written with copying pencil or carbon paper must not come in contact with each other under pressure, even by rolling or folding together, until thoroughly dry; otherwise, owing to the sensitive nature of the copying material, the ink will run and the copies become blurred.

Copying carbon paper and copying pencils being expensive, should be used with care and without waste.

Two Drawbridges on the New York Central Railroad.

Next summer's work on the New York Central will add to the long list of road improvements two steel drawbridges, No. 8 and No. 175, which are of special interest because of the conditions that must be met at the bridge sites. These bridges were designed by the New York Central Bridge Department under the direction of Assistant Engineer F. L. Chase, in charge of bridges. The railroad company will do the substructure work and the American Bridge Company has the contract for the superstructures. Both bridges are two-track draws. Bridge No. 8 is on the River division of the New York Central (West Shore) seven miles from Weehawken.

LOCAL MANIBILL. FREIGHT TRANSCRIPT. (WAY-BILL.)

Stop this Car at ..... For ..... Weighed at

Gross .....

Weigh this Car at ..... Date Abstracted

Tare .....

‡ .....

Net .....

a

CENTRAL OF GEORGIA RAILWAY COMPANY.

CONSIGNEE; DESTINATION AND ROUTE, IF FOR BEYOND MANIBILL DESTINATION		MANIBILLED TO
John Doe, Philadelphia, Pa. by Schr. Lucy.		*Savannah.*
THIS SPACE SHALL BE LEFT BLANK	DESTINATION AND ROUTE (continued) *Nfy. S. Lane, Sav.*	FREIGHT BILL NUMBER
MANIBILLED FROM, DATE * *Macon, Feb. 5, 1901.*	SERIES, NUMBER *B. 841.*	CAR INITIALS AND NUMBER *C. G. 1592.*
		T'F'D TO..... AT

CONSIGNOR, ORIGINAL POINT OF SHIPMENT, DATE, ORIGINAL CAR, CONNECTING LINE REFERENCE

Richard Roe, Yatesville, Feb. 4, C. G. 1592. B. 6881.

NUMBER OF PACKAGES, MARKS, ARTICLES AND CLASSIFICATION CONDITIONS (O. R., C. R., Mel., Gld., Etc.)	WEIGHT	RATE and AUTHORITY	FREIGHT	ADVANCES	PREPAID FREIGHT	COLLECTIBLE
1 Carload Microbes. Shipper's Count O. R. Chafing.	*40,000*	*25*	*$100.00*	*$30.00*		*$130.00*

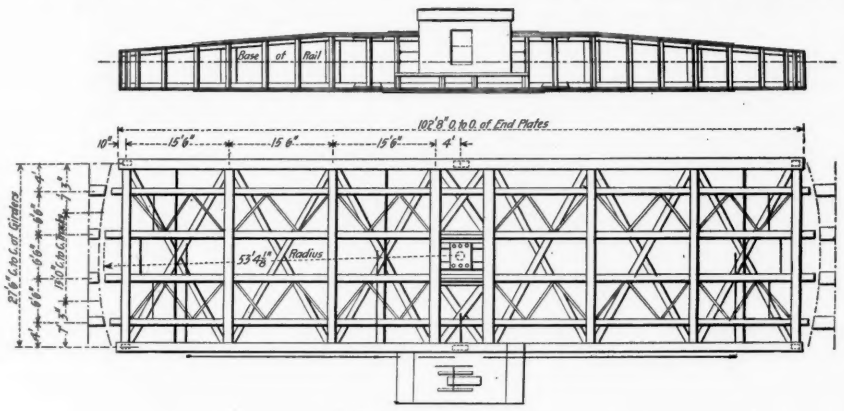
and spans Overpeck Creek, just south of Little Ferry Station. Bridge No. 175 is on the Hudson division of the New York Central just south of New Hamburg, 65 miles from New York, and spans Wappinger Creek. The latter bridge is the more interesting of the two designs, an unusual feature being the curving of the bottom chord to provide a passageway for rowboats and small scows without turning the bridge. Other features of the design were worked out to keep the tracks the standard distance of 12 ft. from center to center; to conform to the fixed distance from high water to base of rail; and to maintain the required clear span for navigation without overhead construction. These local conditions will be referred to later.

Both bridges will be turned by 12 h.p. gasoline engines of the Fairbanks, Morse Company's make. The machinery of bridge No. 8, with the exception of the wedging apparatus, is similar to that of bridge No. 175, the difference being shown in the illustration of those details. The weight, shape, and dimensions of many members, of both bridges, may be found in detail in the illustrations. The latching device, which has been gradually evolved by the New York Central, is simple and effective, and the turning machinery and the latching device are to be interlocked so that neither one can go into action while the other is working.

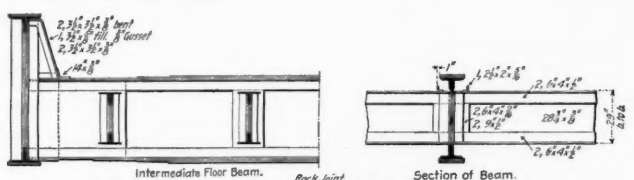
Among the illustrations will be found an outline view of bridge No. 175, showing how much of the old bridge is to be left standing and its relation to the new work. The bridge which is to be replaced is a jack-knife draw, swinging on one end and having a separate pair of girders under each track. The girders for the two tracks swing in opposite directions to clear the channel. Just north of the bridge there is a tunnel and also a station where the tracks resume the normal spacing of 12 ft. from center to center, while just south of the existing draw span, in the space to be occupied by the south arm of the new draw span, there is a through plate-girder span having a center girder. This throws the tracks apart to 15 ft. centers, and one of the objects of the new draw span is to take out the resultant spread between the tracks and have them run parallel at regular spacing of 12 ft. centers.

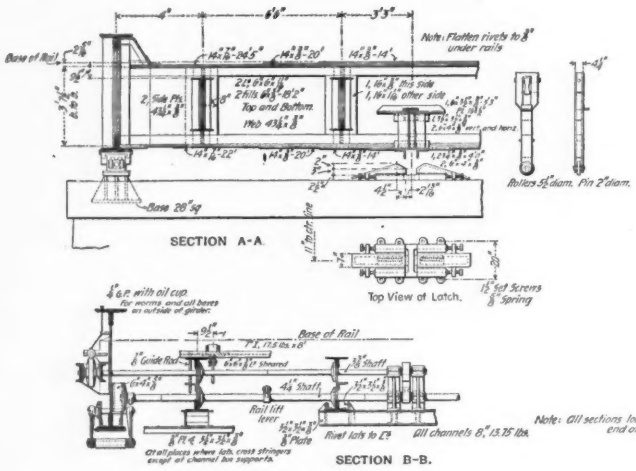
The ruling conditions at this bridge were as follows: The distance from base of rail to extreme high water mark above which all the steelwork must be kept is 5 ft. 6 in. The total length of the draw span was fixed by the existing masonry at 83 ft. It was necessary to maintain a clear channel of 27 ft. on the north side of the center pier, and for this reason the bridge had to be made narrow to occupy as little width as possible when swung to the middle of the stream. It was also required to maintain the standard clearance which, for double track, is 22 ft. 8 in. width at the top of the rail and 26 ft. at a point 5 ft. above the top of the rail. The bridge being exceptionally narrow, it became necessary to keep the top of the girders as low as practicable, and they are therefore very shallow. Furthermore, it was necessary to provide a clear way 12 ft. wide with an under clearance to within 1 ft. 7½ in. of the base of rail for the passage of rowboats and small scows. This necessitated making stringers in the end panels on which rails could rest directly, and that arrangement also serves for the ordinary chair plate that is used under the raised rails at the ends of a draw span.

The present structure would have made it difficult to build a circular center pier and the pier will therefore be made long and narrow, built of New York Central standard concrete and resting on piles. It was not practicable to build a pier at a point which would support the draw span at its midlength, and, as may be noted from the illustrations, it will therefore be a counterbalanced span, one arm of which is 37 ft. long and the other 46 ft. long. The engine house will be built to one side of the draw and this will necessitate counterbalancing transversely

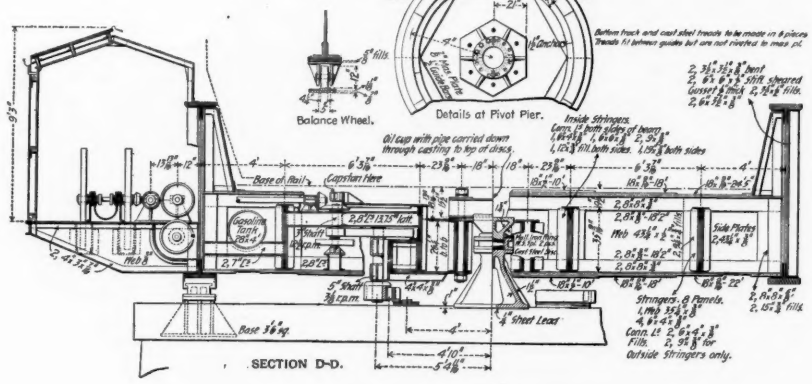


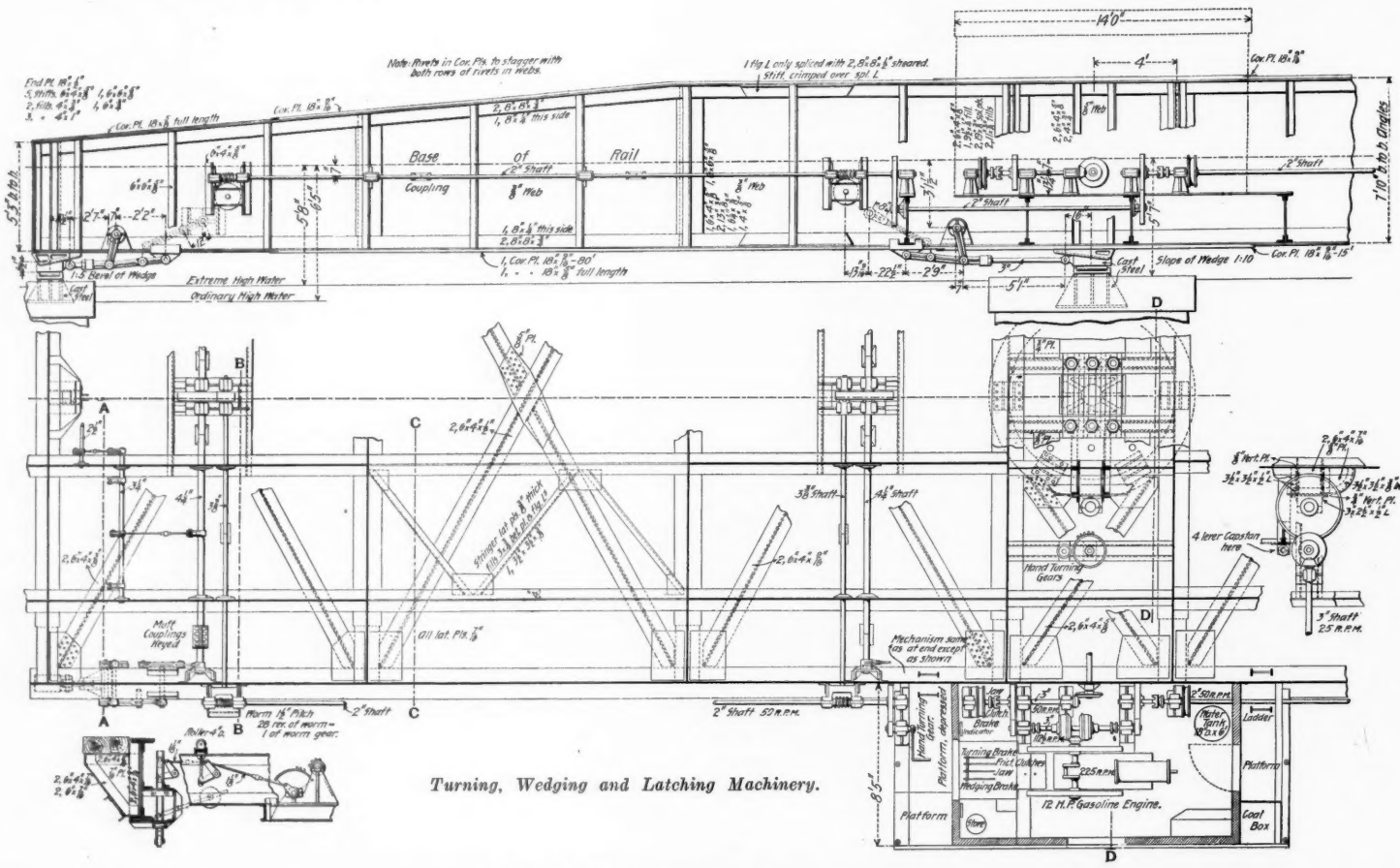
Plan and Elevation.





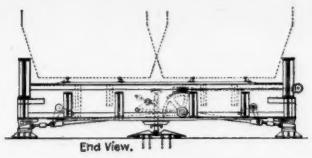
SECTION C-C.

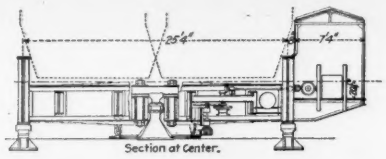


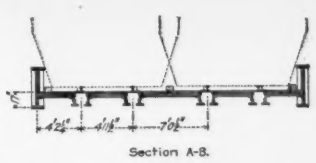


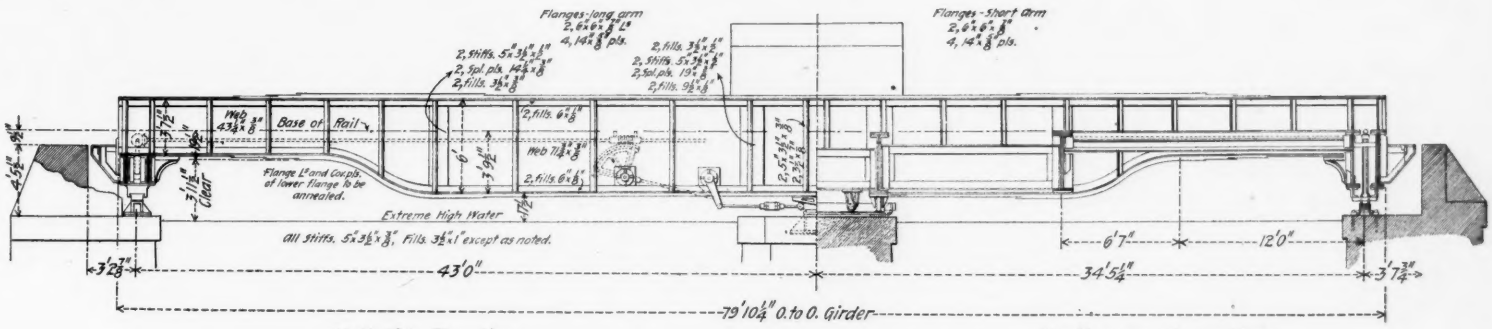
Turning, Wedging and Latching Machinery.

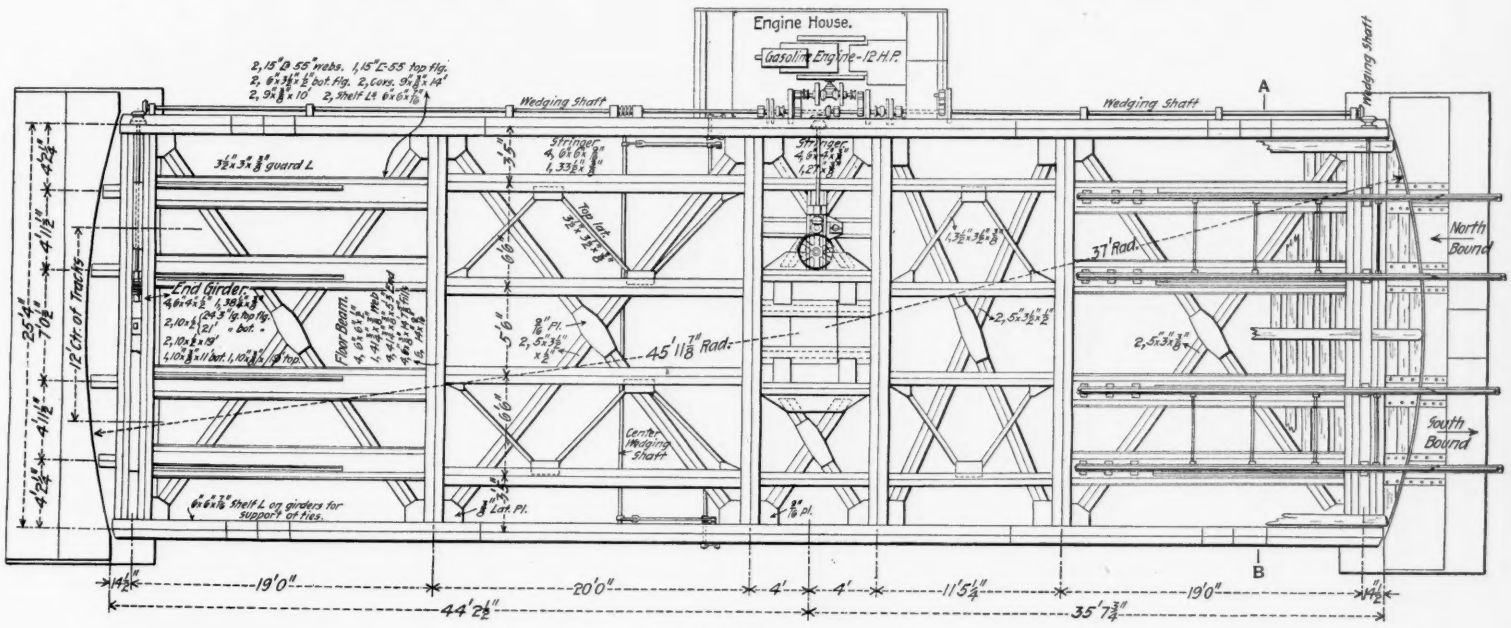
Drawbridge No. 8—New York Central Railroad.



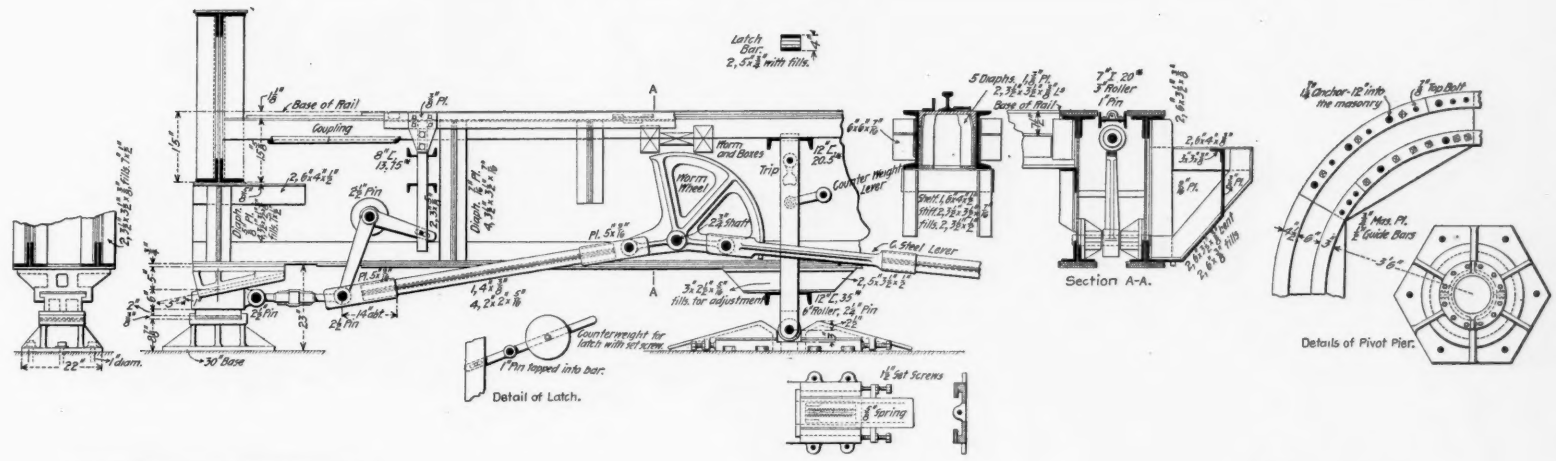


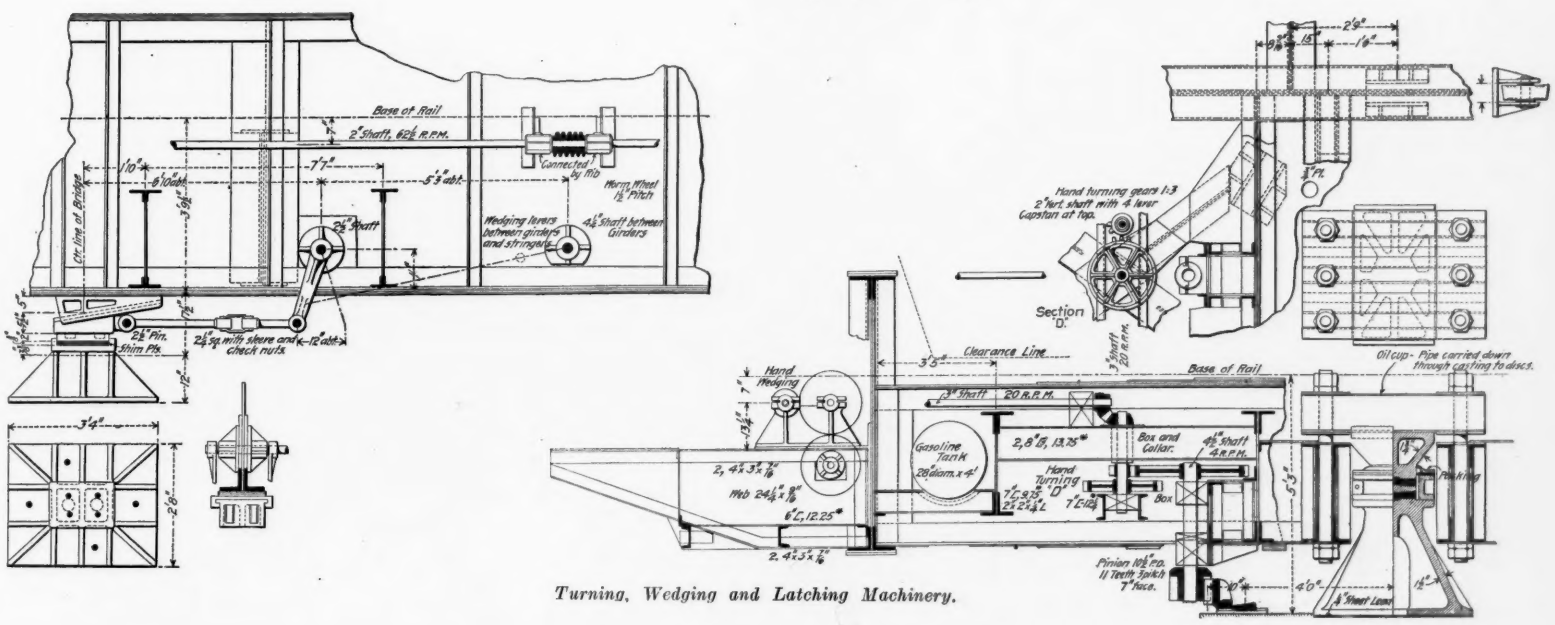






Plan View.




Base of Rail
2" Shaft, 62½ R.P.M.
Horn Wheel 12 Pitch
Wedging levers between girders and stringers
45" Shaft between Girders
Hand turning gears 1:3
2" vert. shaft with 4 lever Capstan at top.
Section D.
Hand Wedging
3" Shaft 20 R.P.M.
Gasoline Tank 28" diam. x 4'
Box and Collar.
4½" Shaft 4 R.P.M.
Hand Turning
Oil cup - Pipe carried down through casting to discs.
Pinion 10½" P.D. 11 Teeth 3 pitch 7" face.
8" Thost Lever

Turning, Wedging and Latching Machinery.

Drawbridge No. 175—New York Central Railroad.

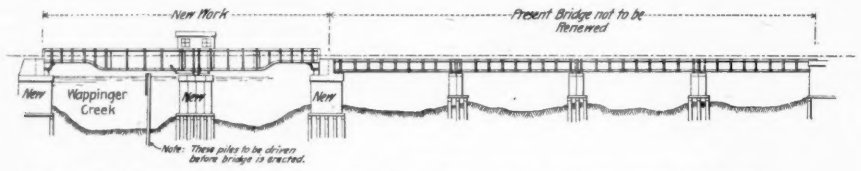
also. The estimated total weight of bridge No. 175 is 326,857 lbs., of which 77,160 lbs. are in the girders; 11,350 lbs. laterals; 138,138 lbs. floor system; 54,000 lbs. counterweights; and 46,209 lbs. machinery, castings, and other details.

The illustrations show the general design of both bridges and the essential points wherein they differ. Sectional views of details show the suspension of bridge No. 175 at a point above its center of gravity to give greater stability; the rotating and latching devices of both bridges; and the general assemblage of all vital parts.

In the latching device a system of gearing, bell-cranks and connections operates a vertical latch that bears a 6-in. roller in its lower end. The latch is counterbalanced, as shown in detail drawings, and the balance is so established that the vertical bar and its roller will seat but slowly in the notch of the latch block after the roller has climbed the incline that leads up to the latch seat from either side. The counterbalance weight is so adjusted that should the draw be swung too fast the latch will not have time to settle home but will pass over the seat and climb the opposite side of the latch block and the draw span will swing by, thus averting injurious shock. This latch has proved its efficiency on other bridges of the New York Central.

Tables herewith give moments for both bridges under various conditions and for various members. In addition to the data for structural material shown in illustrations the following information in regard to details at the center of bridge No. 8 is given: Suspenders, six, 3½ diam.; distributing girder, six 10-in. channels 35 lbs. section, 4 ft. 1 in. long; four 13 in. x ½ in. x 2 ft. 10 in. plates; cross girder, four 6 in. x 4 in. x ½ in. angles, and two 26 in. x ¾ in. plates;—one top plate 13 in. x ½ in. full length, and a lateral plate extended over the bottom angle; 12 stiffeners 3½ in. x 3½ in. x ⅜ in.; four connecting angles 6 in. x 6 in. x 9-16 in.; three disks polished, face radius 3 ft. 9 in., diam. 12 in., the top and bottom disks being of hardened steel and the middle disk of hard phosphor bronze with oil grooves radiating from a hole in the center.

Details at center of bridge No. 175 are as follows: Six suspenders, 3½ in. diam.; distributing girder, six 10 in. channels 35 lbs. section x 4 ft. 1 in. long and four 13 in. x ½ in. plates, 2 ft. 10 in. long; cross girder, four 6 in. x 4 in. x ⅜ in. angles, and two 24 in. x ⅜ in. plates; one top plate 13 in. x 7-16 in., full length, and the lateral plate extends over bottom angles; 12 stiffeners 3½ in. x 3½ in. x ⅜ in.; four connecting angles 6 in. x 6 in. x 9-16 in. There are three polished disks, face radius 3 ft. 9 in. and diam. 12 in., the top and bottom disks being hardened steel and the middle disks phosphor bronze, as in the case of bridge No. 8, the oiling arrangement being similar.



General Outline of Old and New Work—New York Central Drawbridge No. 175.

MOMENT TABLE—MAIN GIRDERS, BRIDGE NO. 8.

	Dead Load Cantilever. I.	Dead Load Continuous. II.	Live Load Fixed Span. III.	Live Load + Moments. IV.	Continuous — Moments. V.	Maximum + Moment ½ × II. + IV. = VI.	Maximum — Moment ½ × I. + V. = VII.	Total in Terms of VI. + VII.
a.....	—317,800	309,800	1,686,000	1,434,000	—260,600	1,589,500	—419,500	2,009,000
b.....	—1,049,400	295,800	1,808,200	1,319,500	—521,200	1,422,400	—1,045,900	2,468,300
c.....	—2,171,600	—288,800	594,400		—1,134,500		—2,220,300	2,220,300
d.....	—2,611,200	—566,400			—1,699,400		—3,005,000	3,005,000

Max. End Shear = 111,300 in terms of L. L.
I. = — 20,500, II. = 20,000, III. = 108,800, IV.-V. = 92,600.
Resultant = 92,600 + ½ (20,500 + 20,000) = 112,900.

Max. End Reaction = 188,600 in terms of L. L.
I. = 0, II. = 40,500, III. = 183,600, IV.-V. = 169,800.
Resultant = 169,800 + ½ × 40,500 = 190,100.

Max Shear at Center = 269,800 in terms of L. L.
I. = — 109,900, II. = 69,400, IV. = 170,000.
Resultant = 170,000 + ½ (69,400 + 109,900) = 259,700.

Max. Center Reaction = 440,200 in terms of L. L.
I. = 219,800, II. = 138,800, IV.-V. = 338,100.
Resultant = 338,100 + ½ × 219,800 = 448,000 per girder.

15½′ Stringers:
D. L. M. = 9,300.
L. L. M. = 132,500.
D. L. S. = 2,400.
L. L. S. = 47,300.

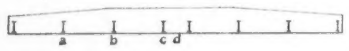


Diagram of Main Girders, Bridge No. 8.

8′ Stringers:
D. L. M. = 2,400.
L. L. M. = 60,000.
D. L. S. = 1,200.
L. L. S. = 33,800.

Int. Floor Beam:
D. L. M. = 100,500.
L. L. M. = 809,300.
D. L. S. = 13,800.
L. L. S. = 111,600.

End Floor Beam:
D. L. M. = 97,200.
L. L. M. = 809,300
D. L. S. = 13,400.
L. L. S. = 111,600.

Center Cross Girders:
Draw closed—
D. L. M. = 130,500.
L. L. M. = 698,900.
Draw swinging:
D. L. M. = — 1,254,000.
Resultant Max. Mom. = 1,391,200 in terms of L. L.
698,900 + ½ (130,500 + 1,254,000) = 1,391,200.

Max. End Shear = 152,300 in terms of L. L.
I. = — 96,600, II. = 15,300, III. = 96,400.
96,400 + ½ (96,600 + 15,300) = 152,300.

Short Girders at Center of Span:
D. L. M. = — 447,600.
D. L. S. = — 111,900.

MOMENT TABLE—MAIN GIRDERS, BRIDGE NO. 175.

	Case I. D. L. Swinging.	Case II. D. L. Continuous.	Case III. L. L. Fixed Span.	Case IV. L. L. Continuous.	Case V.	Max. + Mom. in Terms of L. L. ½ × II. + IV.	Max. — Mom. in Terms of L. L. ½ × I. + V.	Total for Secs. in Terms of L. L. ½ × I. + ½ × II. + IV. + V.
b.....	— 464,800	+ 238,300	+ 1,455,400	+ 1,161,500	— 166,600	+ 1,280,800	— 399,600	1,679,800
c.....	— 1,551,300	— 98,900	+ 424,800		— 478,400		— 1,254,100	1,254,100
e.....	— 1,513,500	— 112,000	+ 365,600		— 589,300		— 1,346,100	1,346,100
f.....	— 775,200	+ 97,900	+ 1,029,800	+ 814,800	— 351,900	+ 863,800	— 739,500	1,603,300
d.....	— 1,880,000	— 299,000			— 1,016,000		— 1,956,000	1,956,000

19′ Stringers:
Max. L. L. moment = 185,000.
Max. D. L. moment = 22,600.
Max. L. L. shear = 51,800.
Max. D. L. shear = 4,800.

20′ Stringers:
L. L. M. = 200,000.
D. L. M. = 18,800.
L. L. S. = 53,100.
D. L. S. = 3,800.

11½′ and 8′ Stringers:
L. L. M. = 83,200.
D. L. M. = 5,000.
L. L. S. = 41,800.
D. L. S. = 1,700.

Floor Beam—Long Arm:
L. L. M. = 855,100.
D. L. M. = 146,800.
L. L. S. = 128,200.
D. L. S. = 22,200.

Floor Beam—Short Arm:
L. L. M. = 750,400.
D. L. M. = 115,600.
L. L. S. = 112,000.
D. L. S. = 17,500.

End Girders:
L. L. M. = 766,500.
D. L. M. = 160,400.
L. L. S. = 114,400.
D. L. S. = 22,000.

Center Girder—Long Arm:
L. L. M. = 706,200.
D. L. M. = 102,500.
— 896,000 swinging.
L. L. S. = 106,200.
D. L. S. = 16,000.
— 73,000 swinging.

Center Girder—Short Arm:
L. L M. = 554,600.
D. L. M. = 70,000.
— 98,000 swinging.
L. L. S. = 83,400.
D. L. S. = 11,000.
— 82,000 swinging.

Short Girders at Pivot:
D. L. M. = — 300,000 swinging.
D. L. S. = — 90,000 swinging.

Main Girders:
L. L. shear at center = 154,000 L. L. continuous } Total in terms of L. L. = 199,000.
D. L. shear at center = 90,000 D. L. Cantilever }
L. L. S. at end = 58,000 L. L. continuous }
D. L. S. at end = 14,000 D. L. continuous } Total for section in terms of L. L. = 76,000.
D. L. S. at end = — 22,000 D. L. cantilever }
L. L. reaction end wedges = 158,800 } Total in terms of L. L. = 158,800.
D. L. reaction end wedges = 0 }
L. L. reaction center wedges = 238,400 L. L. continuous } Total in terms of L. L. = 328,400.
D. L. reaction center wedges = 180,000 D. L. cantilever }

The Accident-Report Law.

Following is the full text of the Federal law requiring railroads to report accidents, which was noticed in our last issue. It was approved March 3.

"It shall be the duty of the General Manager, Superintendent, or other proper officer of every common carrier engaged in interstate commerce by railroad to make to the Interstate Commerce Commission, at its office in Washington, District of Columbia, a monthly report, under oath, of all collisions of trains or where any train or part of a train accidentally leaves the track, and of all accidents which may occur to its passengers or employees while in the service of such common carrier and actually on duty, which report shall state the nature and causes thereof, and the circumstances connected therewith.

"Sec. 2. That any common carrier failing to make such report within 30 days after the end of any month shall be deemed guilty of a misdemeanor and, upon conviction thereof by a court of competent jurisdiction, shall be punished by a fine of not more than $100 for each and every offense and for every day during which it shall fail to make such report after the time herein specified for making the same.

"Sec. 3. That neither said report nor any part thereof shall be admitted as evidence or used for any purpose against such railroad so making such report in any suit or action for damages growing out of any matter mentioned in said report.

"Sec. 4. That the Interstate Commerce Commission is authorized to prescribe for such common carriers a method and form for making the reports in the foregoing section provided."

Sundry Civil Appropriations by Congress.

Rivers and Harbors.—Although the River and Harbor bill was finally defeated by Senator Carter, of Montana, in the closing hours of Congress before adjournment, on March 4, work on continuing improvements of about 40 rivers and harbors under the Engineer Department, U. S. A., amounting to over $7,000,000, was provided for by the Sundry Civil bill, which was agreed to oy both Houses and approved by the President, on March 3. Among the most important of these improvements are the following: For continuing construction of locks and dams in Allegheny River, Pa., at Herr Island, and at Springdale, $126,000; harbor of Buffalo, N. Y., $400,000; Cumberland Sound, Georgia and Florida, $200,000; harbor at Duluth, Minn., and Superior, Wis., $320,000; Illinois and Mississippi Canal, $975,000; breakwater, harbor of San Pedro, Cal., $146,000; Boston, Mass., harbor, completion of 30-ft. depth through Broad Sound Channel, $133,000; Calumet harbor, Chicago, Ill., $255,000; Detroit River, Mich., $325,000; Hudson River, N. Y., $100,000; Mississippi River from the mouth of the Ohio River to Minneapolis, Minn., $157,000; Savannah River, between Savannah and Augusta, Ga., $100,000; Potomac River, below Washington, D. C., $98,000; and for Ambrose Channel, New York harbor and across Sandy Hook Bar, $130,000.

Public Buildings.—Continuing improvements or completion of over 40 public buildings under the Treasury Department were also provided for, among them being: Custom House, New York, under present limit, $500,000; buildings on Ellis Island, New York harbor and completion of immigrant station, $175,000; Custom House and Postoffice, New Orleans, La., for new boilers and heating apparatus and new electrical elevators, $60,000; additions to postoffice building at Newark, N. J., including heating and ventilating apparatus, $85,000; continuing work on new Government building at Indianapolis, Ind., $250,000; continuing work on new Government building, at Cleveland, Ohio, $200,000; Government building, Chicago, $1,000,000; Government building at Baltimore, new boiler plant, $25,000; for completion of the Government building at Altoona, Pa., $75,000; for heating, hoisting and ventilating apparatus and repairs to same for all public buildings under the Treasury Department, except Marine Hospitals, $150,000; for completion of a fireproof building for the use of the Government Printing Office at Washington and each and every purpose connected therewith, under the Chief of Engineers U. S. A., $1,304,000, which shall be immediately available; for an electric light plant to supply all buildings occupied by the Department of the Interior at Washington, including conduits, $74,000; for general repairs at the Capitol building at Washington, D. C., $37,530, and for improvements to the steam heating and ventilating apparatus of the Senate wing, under the supervision of the Architect of the Capitol, $2,150. For the Rock Island Arsenal, Rock Island, Ill., under the War Department, for machinery and shop fixtures, $10,000; for completing of excavating material from the tailrace of the Government waterpower dam below the junction of the tailraces of the Moline and Government dams, $130,500; and for new shops, machinery and general improvements of Frankford Arsenal, Philadelphia, $96,550. A separate public buildings bill, carrying increases of ap-

propriations for over 40 buildings was also passed, the total amount appropriated by the separate bill being about $2,500,000.

Miscellaneous.—For completing one revenue cutter of the first class for service on the Pacific Coast, $112,500; for the completion of a revenue cutter of the first class, under the Secretary of War, for service on the Great Lakes, $82,500; for a survey of Northern and Northwestern lakes, including the investigation of lake levels with a view to their regulation, $100,000.

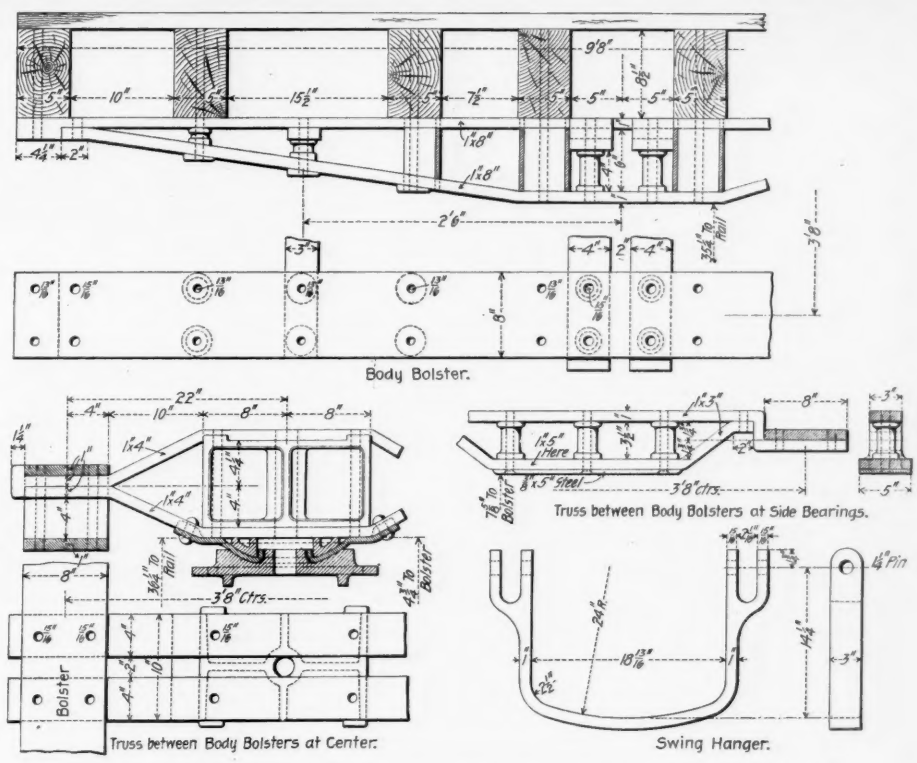
Stocks and Bonds to Be Valued by the Commission.

The Interstate Commerce Commission, under a resolution of Senator Pettigrew, passed at the last session of Congress, is to make up a statement of the value of the securities of all the railroads reporting to the Commission. The resolution says:

"The Interstate Commerce Commission is directed to furnish the Senate with a statement showing in detail the character and par value of all common stock, preferred stock, mortgage bonds, income bonds, car-trust certificates, and other securities issued or authorized to be issued by each railroad company subject to the provisions of the act to regulate commerce, together with the par value of each class of such securities, outstanding on June 30, 1900, the rate of interest or dividends paid thereon during the year then ended, and the market value of such securities on March 31, June 30, Sept. 30 and Dec. 31, 1900."

Four-Wheel Passenger Truck of the Chicago, Burlington & Quincy.

Several roads are considering four-wheel trucks for heavy passenger cars, and in this connection the latest passenger truck of the Chicago, Burlington & Quincy is interesting. This road has had some experience in fast service with four-wheel passenger trucks, with 4¼ x 8-in. journals, the cars weighing about 80,000 lbs. While these trucks have given no serious trouble, the conclusion has been reached that for such heavy cars the margin of safety is probably not large enough, and its four-wheel truck has been re-designed for axles with 5 x 9-in. journals and wheels 40¼ in. in diam. instead of 42½ in. This

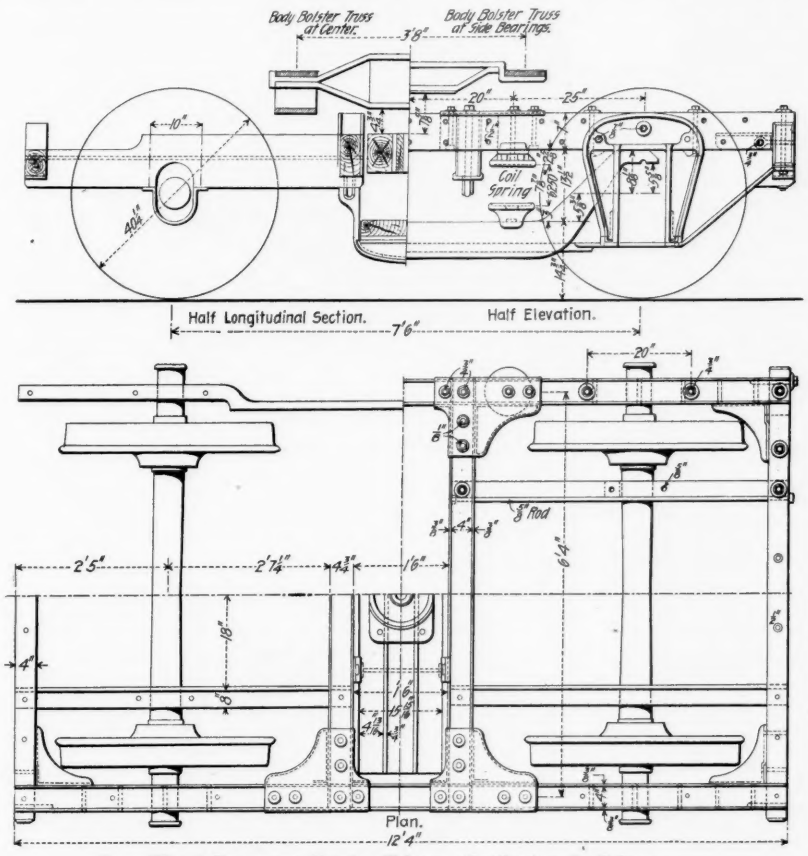


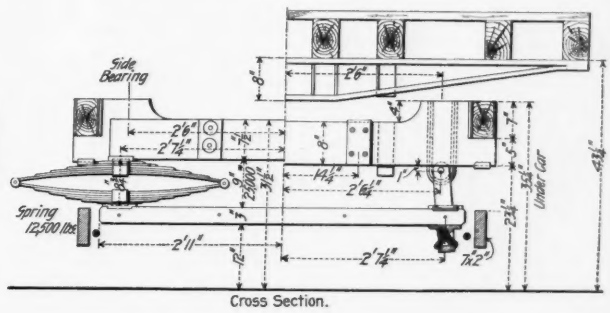
Body Bolster for Passenger Cars With Four-Wheel Trucks—C., B. & Q. R. R.

truck, shown by the engravings, will be used under the new cars now building at Pullman, which will weigh between 80,000 and 85,000 lbs. This lot of cars includes coaches and chair cars 60 ft. long and combination cars 65 ft. long. Wheels 40¼ in. in diam. for passenger service have been adopted as standard by the Burlington.

It will be seen from the drawings that a double body bolster is used. This bolster consists of two parallel trusses built up of 1 x 8-in. plates and spaced 3 ft. 8 in. apart. At the center they are tied together by cross trusses which carry the top center plates. Each of the upper side bearings is also carried on a cross truss. Roller side bearings will be used. The upper center plates are of pressed steel backed up by steel castings. The lower center plates are cast-steel resting directly on the truck bolsters.

The truck frame is of oak and of the usual form, the sides and transoms being plated. The arrangement of the wooden swing bolster, the springs and equalizers is shown by the drawings. The swing hangers are shown in detail. It will be seen that these are wrought iron yokes swung from the transoms which pass beneath the ends of the spring plank. This does away with the lower hanger pins. Beneath the spring plank at each end is a cast-iron concave bearing plate which engages a corresponding bearing carried by the yoke, so that these can rock one on the other. The brake rigging is designed for the use of the Westinghouse high-speed brake, and the brake-shoes are inside hung. The length and angularity of the hangers are proportioned in accordance with the ideas of Mr. R. A. Parke and brought out in a paper before the New York Railroad Club in 1897.





Four-Wheel Passenger Truck—Chicago, Burlington & Quincy

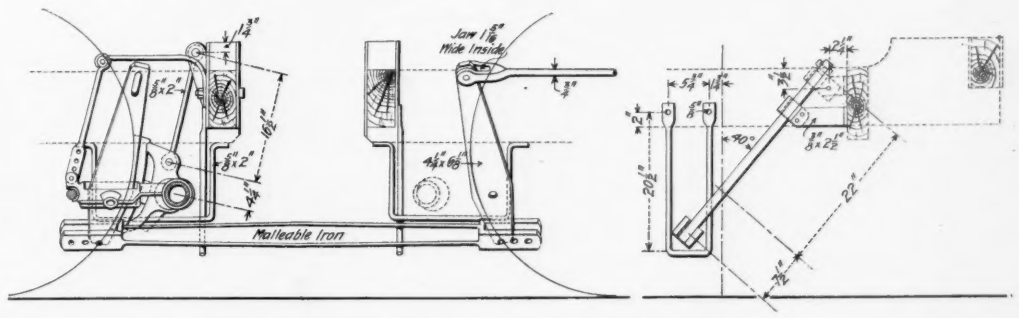
The six-wheel trucks of the Chicago, Burlington & Quincy weigh about 16,000 lbs. each and it is estimated that with the four-wheel trucks shown there will be a saving of at least 6,000 lbs. per car. This saving in weight is chiefly due to the elimination of one axle and the accompanying wheels, journal boxes and pedestals. The axle weighs about 700 lbs. and the wheels about 1,300 lbs. each. The rest of the saving is accounted for by the shorter frame; but one truck bolster, one pair of equalizers, one spring plank are used, and center-bearing and side-bearing trusses and other minor parts are done away with.

We are indebted to Mr. F. A. Delano, Superintendent of Motive Power, and Mr. F. H. Clark, Mechanical Engineer, for drawings and other data.

Yards and Terminals.

The Maintenance of Way Association's Committee on Yards and Terminals (Chairman, A. W. Sullivan, Assistant Second Vice-President, Illinois Central Railroad) gives a careful report, the chief aim of which has been to establish a set of terms and definitions and to present principles of typical methods of practice which are generally applicable. Some extracts from that report follow:

The first work of the Committee was to consider the terms used in this branch of the service, with a view to the adoption of a series of standard terms, as well as to formulate definitions of these terms, in order to have a common understanding in the discussion of the various questions. . . . One of the first difficulties encountered was in regard to the too frequent and indiscriminate use of the word "Yard." This term is now generally applied to the single set of switching and storage tracks



High-Speed Brake Rigging—C., B. & Q. Four-Wheel Truck.

at small stations; to each of the several independent sets at large terminals or division points, and also to the entire series of such sets at the same points. Thus a "yard" may be composed of a number of "yards" (receiving, separating, classification, storage, departure, eastbound and westbound, etc.). Colloquially, this produced but little confusion, but it does produce confusion when the questions involved in yard design and operation come to be considered technically. After having encountered this difficulty several times, your Committee concluded to take the radical step of adopting a new term to designate the entire series of "yards" at important points. The term adopted, after some discussion, is "cluster." . . .

The word "Terminal" has been taken to include all the facilities provided for terminal work, on a large or small scale, while the word "yard" relates only to one set of the tracks which are used for the switching or storage of cars. Terminals may be divided into freight or passenger terminals, and may be further classified as line terminals, division terminals, district terminals, branch terminals, etc.

With these explanations, your Committee presents the following list of terms and definitions:

Terminal.—The facilities provided by a railroad for the conduct of its business at the end of its line, or of a division or a district.

Freight Terminal.—The special arrangement of terminal facilities for the handling of freight business.

Passenger Terminal.—The special arrangement of terminal facilities for the handling of passenger business.

Yard.—Three or more parallel tracks arranged in series for the convenient switching or storage of cars.

Receiving Yard.—A yard for the reception of traffic.

Separating Yard.—A yard next in order to the receiving yard, in which the traffic is separated by districts or commodities, as may be required.

Classification Yard.—A yard next in order to the separating yard, in which the traffic is classified in accordance with requirements, and made up into trains.

Departure Yard.—A yard next in order to the classification yard, in which trains are placed awaiting departure.

Storage Yard.—A yard in which cars are held awaiting disposition.

Cluster.—An arrangement of yards in series, for the separation, classification and storage of cars.

Gravity Yard.—A yard in which the movement of cars is produced by gravity alone.

Assisting Grade.—The elevation given one or more tracks of a yard to facilitate the movement of cars.

Poling Yard.—A yard in which the movement of cars is produced by the use of a pole or stake operated by an engine on an adjoining parallel track. The movement may be facilitated by an assisting grade.

Summit Yard.—A yard in which the movement of cars is produced by pushing them slowly over a summit, beyond which they run by gravity. The movement from the base of the summit may be facilitated by an assisting grade.

Body Track.—One of the parallel tracks of a yard upon which cars are switched or stored.

Ladder Track.—A track connecting in series the body tracks of a yard.

Lead Track.—An extended track connecting either end of a yard with the main line.

Drill Track.—A track connecting with the ladder and used exclusively for movements in yard switching.

Open Track.—A track reserved for movements through a yard.

Running Track.—A track reserved for movements through a cluster.

Cross-over Track.—A track connecting two adjoining tracks.

Special Tracks.—In a typical yard there will be several tracks devoted to special purposes, varying with the local conditions. These will include caboose tracks, scale tracks, coaling tracks, ash-pit tracks, bad-order tracks, repair tracks, icing tracks, feed tracks, stock tracks, transfer tracks, sand tracks, depressed tracks, etc.

Location.—The location should be convenient to the business terminals of the roads, to the freight houses, team tracks and to the points of interchange with other roads or divisions, and should be arranged so that trains can enter and leave the yard without crossing the path of other movements. Where possible, advantage should be taken of natural grades to assist in switching. In some locations assisting grades cannot be had; in others grades can be had in one direction; while in others grades can be used to help in each direction. The assistance of grades is an advantage. . . .

Receiving Yard.—In regard to the design of yards, the Committee first took up the question of freight service at a line terminal (or the actual end of a railway company's line). Considering this matter in proper sequence, we have first the receiving yard, which receives the freight trains coming in off the road. Here the road engine and caboose are cut off, and the work of assorting and distributing the cars is taken in hand by the switching engines and crews. It is very generally assumed that the length of tracks in the receiving yard should be sufficient to accommodate the longest train entering the yard. This does not hold good invariably, however, for the reason that, where very few trains are of the maximum length, the adoption of the maximum length of tracks may involve unnecessary expense as well as an unnecessary amount of switching movements. Under such conditions of traffic it may be preferable to provide for the average train, leaving the maximum train to be taken care of by special means or special movements. The proper length of track for a receiving yard is a relation dependent upon the unit selected, and is governed by the following factors:

1. Length of train of loaded cars.
2. Length of train of empty cars.
3. Average length of trains.
4. Number of trains of average length per day.
5. Number of trains of maximum length per day.

Consideration should also be given to prospective changes in grade and to possible increase in the length of trains entering the yard.

The length of train is the controlling factor and the logical unit. The Committee has arrived at the conclusion that when the trains of maximum length represent less than 20 per cent. of the total number of trains entering the yard daily, then the average train length will be the most practicable basis for a receiving yard having tracks of equal length. The yard may, however, be constructed with a portion of the tracks of sufficient length for maximum trains, and the remainder of the tracks of sufficient length for average trains. In this case, the tracks of each group should be of equal length. Whichever unit is taken (the maximum or the average train), the track should be of such length as to accommodate a train with two engines and a caboose. If the average train length is taken as the unit, then the length of track should be such that a train of the maximum length can be disposed of on not more than two tracks.

The proper size of the receiving yard is a relation dependent upon:

1. The frequency of the arrival of trains.
2. The rate at which cars can be received and disposed of in the separating yard.

The Committee lays down the principle, however, that the receiving yard should have a sufficient number of tracks to hold the trains arriving during one hour of maximum traffic.

Separating Yard.—This yard is the second in the series, and here the first breaking up of a train and the distribution of its cars is effected. The cars entering the yard are usually distributed so that, according as the separations are to be by districts or by commodities, the cars destined to assigned districts, or containing the same commodities, will be placed together on separate tracks. The yard should be located in advance of the receiving yard, and in such a way that cars can be readily moved into it. The number of tracks in the separating yard should be governed by the number of separations to be made. The length of these tracks should be determined by the number of cars for each separation, and there should be extra room allowed for emergencies

Classification Yard.—Here the second distribution or assorting of the cars is effected. When the separation in the preceding yard is by districts, the purpose of the classification yard is to put the cars of the different districts in regular order. Thus the cars of each district (already placed on one of the tracks of the separating yard) are switched in the classification yard in the order required for delivery at destination. When the separation is by commodities, the cars of each commodity (already placed on one of the tracks of the separating yard) are further assorted by classes or grades. Thus all the cars of grain, placed indiscriminately on a track in the separating yard, will be rearranged in the classification yard so that the cars of wheat, corn, oats, etc., are each grouped on separate tracks. The classification yard should be located in advance of the separating yard, and in such a way that cars may readily be moved into it from any of the tracks in the latter yard. It is usually in the form of a gridiron, and its capacity will be determined by the number of cars going to a district, with ample allowance for an excess number or for emergencies. As an example: With 36 cars going to a district, two "gridirons" of six tracks each, with a capacity of six cars to a track, will give such control of the entire set of cars that it can be turned end for end, or car for car. This type of yard may be made up of a series of parallel stub tracks instead of gridirons; such an arrangement is sometimes termed a lancing yard.

Departure Yard.—In this yard the trains made up in the classification yard are held awaiting departure. Here the work of the yard engines and their crews ceases, and that of road or transfer engines and their crews is commenced. It should be located in advance of the classification yard, so that cars from all tracks in the latter can be readily moved into the departure yard. The number of tracks and the length of tracks in this yard are governed by the same requirements as those governing the receiving yard.

Storage Yard.—This yard is for the reception of cars which have to be stored or held awaiting disposition, instead of being put into trains and sent forward. The location of the storage yard is very important and depends almost entirely upon the character of the cars to be stored or held. Three distinct cases may be mentioned:

First—On some railroads, it is known in advance that entire trainloads of business arriving will have to be held. In such cases, the storage yard should be located with or in close relation to the receiving and separating yards, so as to permit of direct movement of trains into the storage yard, and then into the separating yard as required.

Second—The cars to be held may arrive mixed in with cars that are to go forward. In such cases, the storage yard should be so located in relation to the separating yard that the cars can be moved directly into the storage yard from the separating yard, and then delivered to the classification yard as required.

Third—The character of the freight to be held may be such that it can be put in district and station order at once. In such cases, the storage yard should be located in such relation to the classification and departure yards that cars can readily be moved directly into the storage yard from the classification yard and then delivered to the departure yard as required.

There are probably other cases, but we have mentioned three of the principal ones to indicate the fact that the location of the storage yard cannot be determined arbitrarily or theoretically, but must be dependent upon the character of the business in each case. The size of the storage yard should be governed almost entirely by the number of cars to be held, and the length of the tracks should be such that a switching engine can readily handle all the cars standing on one track. . . .

Body Tracks.—These should be spaced 11 ft. 6 in. to 13 ft. c. to c., and while the minimum spacing is not to be recommended for general use, it is often desirable to use it for the purpose of utilizing the space in city yards to its fullest capacity. At intervals of five or six tracks an extra width of spacing should be given, in order to allow space for drainage and for the piling of track material, etc. It is also advisable to allow a space of 15 ft. between the center of a main track and a yard track, so as to give ample space for water columns or standpipes, signal-posts, etc.

Ladder Tracks.—Where there are two ladder tracks, or where another yard track parallels a ladder track, these tracks should be 15 ft. c. to c. The extra room is required for the safety of trainmen in throwing switches and moving in and out between the cars. The angle which the ladder track makes with the body tracks should be the greatest angle which the frog used will allow. Your Committee recommends that No. 7 should be the minimum number of frog for yard use. Frogs of higher number are often preferable and are often used, but it must be remembered that the easier curves of such frogs require longer leads and consequently occupy more yard space.

Lead Tracks.—The connection of these tracks with the main line should be controlled by a telegraph office and interlocking plant, both for safety and to facilitate train movements.

Drill Tracks.—These tracks should be so located as to cause a minimum interference with other movements.

Open Tracks.—The track selected as the open track should be one that will enable movements to be made from one end of a yard to the other with the greatest convenience.

Running Tracks.—Tracks of this class should be located with the greatest care. Such tracks should be provided for movement in each direction, to enable yard engines to pass freely from one portion of the cluster to another, also for road and yard engines to go to and from the engine house and other points where facilities are located.

Cross-over Tracks.—These should be located at the most convenient places, and where they will interfere as little as possible with regular movements.

Special Tracks.—In addition to the foregoing, there will be tracks required for special purposes, sufficiently indicated by their names. Several of these have been enumerated in the list of definitions already given, and particulars as to some of them are given below.

Caboose Tracks.—Cabooses arriving at a yard usually return over the same division, instead of going forward. It is, therefore, usually necessary to locate them between the receiving yard and departure yard, and to arrange them so that the cabooses can readily be pushed from a receiving track to the caboose track, and then dropped by gravity on to a train departing in the direction from which the caboose has arrived. There are various ways in which this can be accomplished, but in locating these tracks care should be taken that only a minimum amount of switching will be required. The tracks should be so arranged that cabooses feed forward, first in—first out. Occasionally special tracks may have to be provided for the cabooses of fast freight trains.

Scale Track.—This is usually located between the receiving and separating yards. This is undoubtedly the best location when automatic weighing is adopted, and no reverse movements should be required in taking the cars on and off the scales.

Coaling, Ashpit, Sand and Engine Tracks.—The engine-coaling facilities are usually located on the track leading to the engine house. Water and sand should also be taken at the same time as the coal, where it is possible to arrange this. The facilities for supplying coal, water and sand are sometimes provided on the outgoing engine house track, as well as on the incoming track. It will be of advantage to provide a run-around track, so that switch engines may clean fires, take coal and water and pass around waiting road engines.

Bad Order Tracks.—These are required in order to get the bad-order cars out of the way of the switching movements, and they should be so arranged as to be easy of access at all times. From them the cars are taken to the repair tracks.

Repair Tracks.—These should be conveniently located, connecting with bad-order tracks, when practicable. They should be laid in pairs, 16 ft. c. to c., with space not less than 24 ft. between each pair for the handling of material. The length of repair tracks should not, ordinarily, exceed 15 cars.

Icing Tracks.—These should be located between the receiving and separating yards, so that the cars to be iced may be readily moved from the receiving yard to the icing track, and thence to the separating yard.

Other Special Tracks.—The particular purpose for which such tracks are required should be carefully considered, and the tracks should be so located that their use will involve a minimum amount of switching, and the least possible interference with the regular yard movement.

In presenting this report, your Committee desires to state that it has considered the designing of a yard with reference to the movement of traffic in one direction only.

For movements in the opposite direction, a duplication of yard facilities will be required. Yards should be provided for traffic in each direction.

The Imperial Combination Hand Car.

The usefulness and economy of a combination car that can be readily changed from a push car to a hand car suitably geared for light, fast running or for carrying a heavy load has long been recognized by track men and by designers. These, with durability, are the features of the new "Imperial" combined traction and push cars sold by Mr. J. R. Vandyck, of New York. Two forms are illustrated herewith, A and D, the lightest and the haviest of the standard sizes. These cars can be equipped with any desired special attachments. Car A has a narrow, low deck for light service; platform 6 ft. 8 in. long x 4 ft. 4 in. wide; wood and pressed steel wheels, 20 in. in diameter; foot or hand-brake, and the weight is 550 lbs. Car D has a wide, high deck for heavy service; platform 7 ft. 6 in. long x 5 ft. 6 in. wide; wood and pressed steel wheels, 20 in. in diameter; foot and hand-brake, and the weight is 700 lbs. The removable gallows, the standard of which is malleable iron, fits into a malleable floor plate and lower socket. The shank and socket are square tapered, and therefore take up the wear.

No bolts are used to fasten the gallows in place. The standard is dropped into the socket after the hook is connected with the gear wheel. A single throw of the cam-latch lever, best shown in Fig. 1, draws the standard tight in the socket by setting the lip of the latch up under the edge of the center plate.

Adjustment of the sweep of the handle-bars is made by shifting the sliding head shown on the cross-arm. For high speed and light load it is set out toward the end of the cross-arm, and gives a minimum sweep of 8 in. This avoids danger of men being hurt by the handlebars while running fast. When greater leverages and slower speed are required the crank-rod head is set toward the standard, and a handle-bar sweep through 20 in. is obtainable. This change can be made while running, and the stroke is made positive by a set screw that seats in the notched rib shown on the side of the cross-arm. In Fig. 2, one of the D cars is shown with gallows removed. A canvas cover is furnished to put over the socket plate when the cars are to be used to carry ballast and the like.

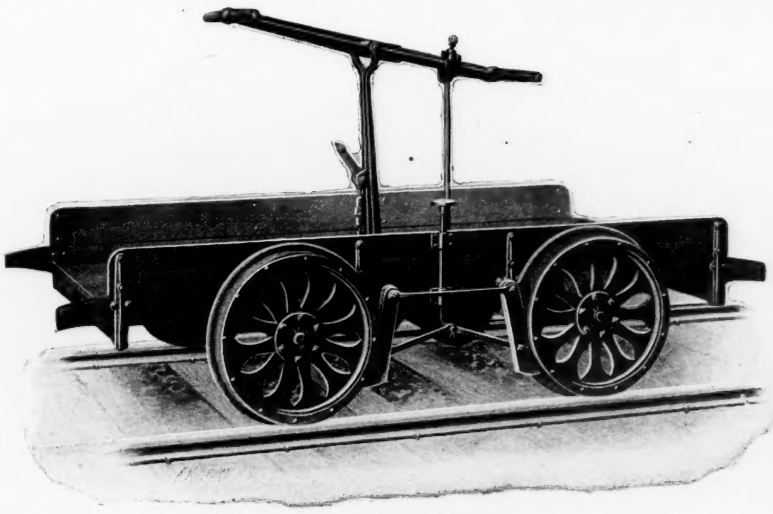


Fig. 1.—Imperial Hand Car "A."

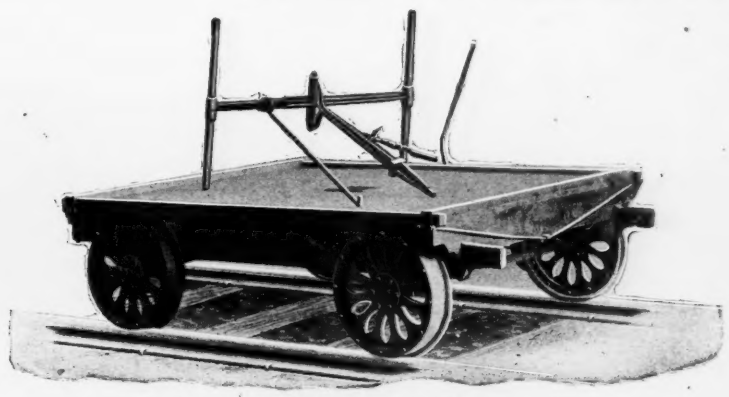


Fig. 2.—Imperial Hand Car "D."

One of the A cars was recently tested on the Central Railroad of New Jersey, with very satisfactory results. It carried a load of six men and eight ties at an average speed of 15 miles an hour, and at one point two miles were run and the car removed from the track inside of seven minutes. When running light, a speed of 20 miles an hour was attained without any particular effort for high speed.

Graduation.

The Committee on Graduation of the American Railway Engineering and Maintenance of Way Association presents a careful report of 10 octavo pages. We have room for only a few extracts, which follow. The Chairman of this committee is Mr. W. McNab, Assistant Engineer of the Grand Trunk Railway.

The term graduation as here used is intended to embrace the preparation of the ground, the excavation and placing of the material, and other general work incident to the formation and maintenance of the railroad roadbed and yards. . . .

Innumerable instances are noticeable in which much expenditure after construction might have been avoided or minimized, if false economy had not been originally practiced, by making insufficient width at sub-grade, and giving too steep a pitch to the slopes of the cuts and fills, as well as by the neglect of drainage features, requiring ultimately substantial rectification. . . .

The committee has made an analysis of the drawings and specifications of representative railroads in all parts of the country, and the fact intimated in last year's report that great dissimilarity exists in standards, even under similar general conditions, is much emphasized by this analysis. . . .

After this analysis, the committee is of the opinion that in many instances a needless refinement is exhibited in regard to the shape of the roadbed at sub-grade, viz., a curve, series of curves, or a series of planes at various angles, shapes which are not easy to make and maintain, and are rarely adhered to in actual practice. Simple drainage planes of a uniform slope of .04 per foot falling from each side of the center line of roadway are easy to make, and are found to be effective. The width of roadbed is also, generally speaking, too narrow—20 ft. on embankments, and a corresponding width between ditches in cuts should be taken as minimum for single track, on what may be termed a first-class road, with an addition of 13 to 14 ft. in case of double track. The surface ditches in cuts should be kept well below the intersections of the sub-grade planes with the planes of the slopes of the cut, and the shape such as can most economically be maintained Surface ditches on curved portions of the road should be on the same level, the inclination of the track being made up in the ballast.

It is the intention of the committee in a future report to submit sketches of roadbed with its several accessories, that might be taken as a standard for a first-class road, and at the same time show how such can best be modified to suit these smaller lines. . . .

In preparing unstable ground for the embankment, it should be subjected to the closest examination as to its nature, with a view to remedy before placing material upon it. Preliminary drainage is frequently all that is necessary. If the land is swampy, with a thin crust of insufficient strength for the weight to be supported (commonly called a "sink hole"), it may be necessary to continue filling in material until a solid foundation is obtained, in order to secure a roadbed that can be used with undiminished speed, but there are numerous other methods, each depending on local conditions.

If the swampy material be on a side hill, it should first be drained by means of a side ditch on the upper side, parallel to the roadway, and the water led off to the lower side by means of cross drains.

A case has been noted in which a swamp or bog of about half a mile in length is being crossed by a line at present under construction. This swamp or bog consists of a black soil somewhat like peat in its nature, which holds the water tenaciously. A ditch on either side of the embankment at a distance of 75 ft. from the center line was excavated down to the sand and gravel, a depth of 3 to 6 ft., but the water still stood between these ditches, and the bog material was about as impassable as before the ditches were cut. Cross trenches were then cut at intervals of about 50 ft., and boxes of 3-in. plank, open at the bottom, were put in, with a result that the ground has now dried up sufficiently to enable the material from the adjacent cuts to be hauled on to it, and from present appearance it is anticipated that the weight will squeeze the water out of the blocks of ground into which this is divided, and eventually give a dry and good roadbed. . . .

Much depends upon homogeneity in the mass of the fill, and to this end it is advisable (especially in woodland districts where there is frequently a leaf mould overlying a substantial sub-soil) at the end of cuttings, to strip the surface soil, if it is light and porous, to a depth of 18 or 20 in. below the grade line, and dump the portions of soil thus stripped into fills which would be a greater depth than 2 ft. below grade. By this means the sub-soil material in the portions of the roadbed immediately below grade would be continuous from excavation to embankment. Homogeneity in the mass is naturally a check against large moves, and at the top it is especially felt by giving a uniform firmness during summer, and a greater freedom from heaving in winter. . . .

Allowance for shrinkage of embankments of 3 to 7 per cent., according to material, should originally be made. It would be better to provide for this shrinkage by making the roadbed wider than standard, instead of adding to the vertical height, so that when settlement takes place, there will be width enough to fill out, and not unduly run down the slope. . . .

The fundamental principle in maintenance is to keep the roadbed dry, and to insure this every reasonable means should be employed to intercept the natural course of water from outside sources that would otherwise reach the roadbed, and then if by this means a sufficient degree of dryness is not attained sub-drainage should be employed. . . .

Protection of Slopes.—Protecting the face of slopes on the older and more important lines is receiving much attention, and where done has been generally beneficial and added much to the appearance. Sodding is the best and simplest method, if it can be well started and has sufficient proper soil to subsist upon. In most cases the extra expense of sodding, especially at time of original construction, will be made up in a few seasons by the security it gives against heavy maintenance charges. Sods from high well drained ground are the best, as those from swampy localities are apt, if exposed to the sunny side of a cut or fill, to dry out rapidly and disintegrate; still the latter can be used to advantage on the shady side of slopes, but the former are more resisting from their previous condition of growth. Sods for transplanting are best when about five years old, but in laying extreme care is needed, and they should be secured by slender hardwood stakes driven well down into the ground, where the material on which they are laid is inferior.

Supplemental to the sodding, improved results can be obtained if for the first year a good mixture of timothy and oats seed be sown; it quickly forms strong roots and helps to hold the sod in place; afterwards as may be needed, a mixture of Kentucky blue grass, white clover, perennial rye, red fesco, and red-top in the proportions of 8, 4, 9, 3, 8, respectively, making 32 lbs. per acre.

Before sodding is begun, the slopes should be dressed to a reasonably fair shape. It is practically useless, however, to attempt sodding on unstable clay slopes which slide so deep as to carry away both sods and pegs, or on poor soil or barren slopes on which it soon burns out. When such conditions exist, other methods have to be adopted.

In warm climates, slopes of embankments composed of sandy material may be successfully protected by setting out on the embankment small tufts of Bermuda grass, planted about 18 in. apart in each direction, the sod being collected and cut into pieces about 6 in. square. It is found that such frequently makes a substantial sod of Bermuda in 12 months. . . .

Excellent protection on some soils, such as silt or slippery clay, and especially as a guard against washing, where the embankment is alongside the course of a stream which rises and falls considerably, is attained by planting willows. . . .

Slag or ordinary rip-rap deposited in a layer of 3 ft. or more in thickness below water, and 2 ft. above water, has been found generally an efficient protection against abrasion of embankments subject to ordinary currents or the wash of lakes, etc. In heavy rip-rap, i. e., where large stones are used with fair regularity, the bed of each stone in the face of the wall should be laid at right angles to that face, and a "V" shaped trench dug, and foundation of the rip-rap laid in it, where there is danger of undermining and settlement of the rip-rap wall. Where the bottom is mud or quicksand, or liable to scour, brush may sometimes be satisfactorily used underneath the rip-rap.

An instance may be mentioned of a high bank which carried a track tank, failing from the accidental overflowing of the tank, and which was successfully treated by first digging a trench outside the foot of the slope about 4 ft. deep, and at such a distance from the foot of the bank that a broken rock slope could have an inclination of two horizontal to one vertical. The trench was then filled with rock, and the whole earth slope covered with rock. This protection was efficient, and considerably less expensive than masonry walls would have been.

There are many banks in which protection has been furthered by placing blind drains in the slopes at right angles to the line of track, consisting of loose rock put in ditches about 3 ft. wide and 4 ft. deep. Most of these banks had sloughed out more or less, and this sort of protection is an added feature, frequently after long use of the embankments. These broken stone drains serve the double purpose of carrying off sub-water, and acting as buttresses for the support of the embankment.

There are some instances where heavy cuttings exist through light sandy soil, in which the face of the slopes have been protected from the action of the wind by covering them with a layer of clay from 4 to 6 in. thick.

In this layer of clayey soil, grass and small shrubs take root, and serve still further to protect the slope. In sandy soils, good results are also obtained by spreading engine cinders over the slopes of embankments and cuts, and very little washing away of the soil then takes place. The use of cinders on the slopes of cuts also prevents the drawing in of large quantities of dust during the passage of trains.

Retaining Walls.—The general subject of retaining walls is an important one, and the committee has in view an investigation of the general practice in a manner worthy of this importance. In subsequent reports it is the intention to present data and sketches illustrative of typical methods adopted throughout the country. . . .

Improvement of Grades and Alignment.—For lack of sufficient time the committee has as yet been unable to investigate in detail this important subdivision of its work, but a few salient features in connection therewith may be outlined in the meantime, as embracing the ground to be covered in future reports, and which for the present may form a basis for discussion. . . .

The recent investigations carried out by a committee of the Southern Pacific Company, and embodied in a pamphlet (which, through the courtesy of that organization, the Association has been enabled to publish as a bulletin), is a long stride in the right direction. . . .

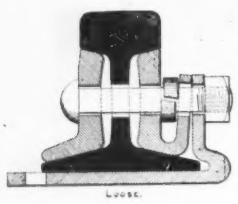
The value of momentum in surmounting grades taken into consideration in calculating "virtual" or "equivalent" grades must not be lost sight of, as cases of increased load as high as 15 per cent. have frequently been met with, when advantage was taken of the momentum; and grades should also be so revised that in overcoming the heaviest there will not be an undue excess or waste of power on the lighter ones, with all that that implies. The controlling grade compensated for curvature should be fixed if possible over a whole division, or at least a whole operating district, that is, the length of a freight-train run, in order that the loading of engines may be simplified, and the use of assisting engines avoided as far as possible. . . .

Where tests have been carried out on an extensive scale, it has been found that 0.03 per cent. compensation for each degree of curvature for all curves up to and including 2 degrees, 0.04 per cent. above that and up to 5 degrees, and 0.05 per cent. above 5 degrees and up to 10 degrees, is good practice. For a high speed line, all curves 2 degrees and above should be spiral, taking a speed of 50 miles per hour, but in no case should the super-elevation of the curve be more than 8 in. . . .

The Ward Rail Joint.

This is the invention of Mr. D. O. Ward, General Manager of the American Washer & Mfg. Co., of Chicago and Newark, N. J. Mr. Ward has had many years' experience with devices which pertain to the make-up and maintenance of rail joints and offers his new device as what his experience suggests as necessary to economically provide surface and alignment of rails at the joints. It is shown by the accompanying engraving and is described as follows:

"Those who believe in a base-supported joint will readily understand that this type of joint should be provided with a cushion on its outside and this cushion should be a practical element, to absorb shocks due to lateral thrusts, radiating from the wheel flange, as it is well known that a loose base-plate joint is a bad rattler and will soon pound itself to death. If a base type of joint can be kept absolutely tight no considerable blow may be delivered to the bolts and other members of the joint. It is, however, conceded impossible to assemble several metal parts and subject them to the impact and vibrations of passing wheels, and to the equally potential elements of expansion and contraction, and long maintain a tight joint. We have therefore introduced a new feature, a principle not heretofore employed in a practical form, to overcome the difficulties encountered in a base supported loose joint. This is a compensating force in the upright extensions which are so shaped as to develop powerful resilience when a wrench is applied to the nuts. At the same time these upright legs act in connection with the angle bar forms as supporting girders to resist direct stress from above. These spring arms, as they may be called, will effectually take up all wear, or, more properly, act to preserve all bearings and prevent wear.



"A portion of the rail flange, it will be observed, is clamped by the curve in the shoe or base-plate to prevent impact of the rail base against the base-plate when the rail rises and falls, especially when a tie is low. In the opening in the "U" bar a filler of wood may be used. The shrinkage of this wood in dry weather is of no consequence, as it performs no function whatever, acting merely as a filler. Powerful spring washers set in the "U" bar where each bolt passes through are preferable to wood, as they are not affected by the weather, and are not subjected to forced strain, as a fatiguing pressure cannot reach them through the walls of the "U" bar, and we have in the washers very efficient auxiliary spring force.

"Only two rolling fits are attempted in the Ward device, the base support being a gravity fit, and all difficulties pertaining to the rolling of this joint have been overcome and the company is now offering the joint to the trade."

Reconstruction on the Union Pacific.*

There are many in the East and South who have only faint ideas regarding the heavy construction being generally carried on by the great transcontinental railroad lines in their efforts to reduce grades and straighten alignments. Among others, the Union Pacific Railroad has shown remarkable activity in this direction. Its line has been shortened by many miles and its grades reduced to a maximum of 0.82 of 1 per cent., compensated 0.03 for each degree of curvature, the maximum curvature allowed being 4 deg. On all new construction everything is being carried out to a perfect working model.

The highest summit on this line is at Sherman Hill, an elevation of 8,247 ft. above sea level, 33 miles west of Cheyenne, and 23 miles east of Laramie, Wyo. To overcome some of its difficulties a corps of engineers was placed in the field early in 1899 to locate a line from Laramie to Buford, the latter being a small station seven miles east of Sherman. Several months were spent in locating the line, the final result exhibiting a large amount of curvature and an irregular profile. The summit, however, was lowered 240 ft., and the maximum grade was obtained by tunneling 3,400 ft. Not until the first part of April, 1900, did the company finally decide to construct, and appointed D. C. Dunlap, M. Am. Soc. C. E., as Resident Engineer in charge of the entire cut-off, with headquarters at Laramie. [Mr. J. H. Berry is Chief Engineer of the Union Pacific and had active control of all this work.—EDITOR.] Under his able supervision the preliminary location was so altered as to reduce the length of tunnel to 1,800 instead of 3,400 ft. He also made other modifications, which reduced the cost materially.

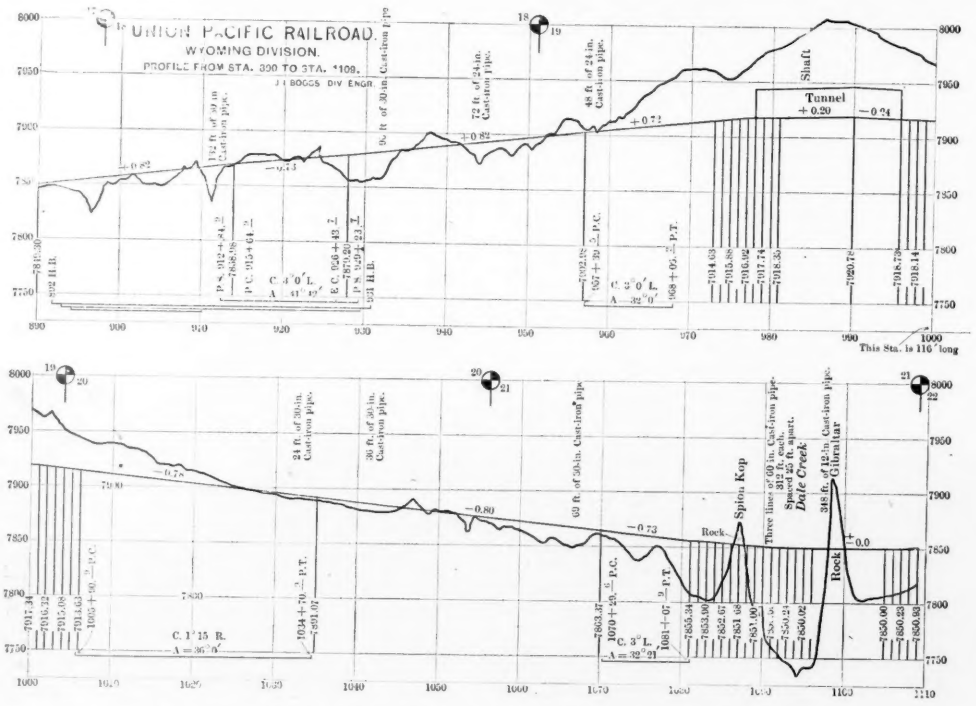


Fig. 1.—Profile of Union Pacific Railroad—Rocky Mountain Summit.

On April 18 the contract to build the line was awarded to Kilpatrick Bros. & Collins, with a time limit of two years, and a bonus if finished in one year (which meant eight months). This firm afterward sublet the greater part of the work, reserving for itself that portion from Station 978, the west portal of the tunnel, to Station 1,098, these 120 stations being the most difficult part of the entire cut-off.

The writer had immediate charge of what is known as the Second Division, extending from Station 898 to Station 1,109, and his remarks will be confined to operations along these four miles, it being the purpose to present as concise a description as possible of the heaviest part of this very heavy work.

The curvature on this division was comparatively light, the maximum being 3 deg., with a total of 142 deg. 3 minutes in angles, divided between four curves; but the grading was extraordinary, the quantities being as shown in Table No. 1.

*By J. J. Boggs, Assoc. M. Am. Soc. C. E., to be presented before the Society March 20, 1901.

Of the 723,755 cu. yds. of embankment on Section 21, 475,268 cu. yds. were in the fill at Dale Creek, between Stations 1,088 and 1,098. See Fig. 1.

The work was divided as follows:

Station 898 to 907, Mahoney Brothers; Subcontractors.
Station 907 to 925, G. C. Smith; Subcontractors.
Station 925 to 971, Mahoney Brothers; Subcontractors.
Station 971 to 978, Beaumier Contracting Company; Subcontractors.
Station 978 to 1,078, Kilpatrick Brothers & Collins; principals.
Station 1,098 to 1,100, Rowan & Scott; Subcontractors.
Station 1,100 to 1,109, Cushing & O'Kief; Subcontractors.

This being on the summit, there was no bridging to contend with, all water courses being taken care of by means of 24 and 30-in. cast-iron pipe with the exception of Dale Creek, where three lines of 60-in. cast-iron pipe were laid in concrete. . . .

At the outset the contractors had to do much preliminary work; the building of a spur track two miles long for the ready delivery of material, from the main line of the Union Pacific Railroad; blacksmith and machine shops to be erected; electric light and compressed air plants, with their attendant wire and pipe lines, to be installed; a shaft for the tunnel to be started at once; nearly two miles of double-track 3-ft. gage railroad to be built; a pumping station to be placed on Dale Creek, with a pipe line extending to Station 960; besides many other important items, all demanding immediate and close attention, with not a day's time to lose, as the seasons in this altitude and latitude are very short, the last snow storm having occurred on June 9 and the first of the next season on Sept. 26. . . .

May 15 may be set as the date of the beginning of actual operations, for, although a number of teams had been working on the grade previous to this date, it was not until this day that the steam shovels were started. . . . From this time on machinery was rapidly put in place, until finally there were in operation eight steam shovels, and 15 locomotives with trains of from 10 to 18 3-yd. dump cars each. The machine drills were run by compressed air, and work was carried on both night and day, the works being lighted by electricity.

From May 15 to June 1 steam shovels and teams were engaged in building the embankment, from Stations 1,070 to 1,085, up as high as the "Spionkop," near the 7,825-ft. contour, or 27 ft. below grade. On June 4 a line following this contour as closely as possible was located around the hill for the 3-ft. gage railway, the curves running from 40 to 70 deg. At Stations 2 + 71 and 4 + 73 on this narrow gage line, split switch points were inserted, and about June 8 the active construction of the immense fill may be said to have been begun, by side-dumping and constantly throwing the track ahead. This side-dumping was continued until about July 19, when, owing to the failure of the foundries to supply the 60-in. pipe promptly, the work on the west side of the creek had to be temporarily stopped. The contractors then commenced filling to the grade line west of "Spionkop." Prior to this, however, a line had been located and con-

TABLE NO. 1.

Class of Work.		18	Section No. 19	20	21	Summary.
Embankment	(cub. yards.)	81,545	.....	7,225	723,755	812,525
Earth excavation	" "	3,860	27,215* / 27,300†	36,391	.....	94,766
Solid granite excavation	" "	13,214	130,330* / 105,039†	52,569	11,105	312,257
1,800-ft. tunnel, solid granite	" "	.....	000'23	.....	.....	35,000
Totals	(cub. yards.)	98,619	324,884	96,185	734,860	1,254,548

*West tunnel approach. †East tunnel approach.

structed on the 7,790 ft. contour, from a borrow pit on the east side of Dale Creek, around the base of "Gibraltar" to the south line of slope stakes. Here, one shovel and two trains were constantly pouring in material, in the quadrant of a circle whose radius was the distance between the opposite slope stakes, the track being occasionally lengthened by means of temporary trestles, one of which may be seen on the left in Fig. 2. It was not until July 30 that the 60-in. pipes were in place, and work was resumed on the west side. By this time the bank west of Station 1,086 had been filled to grade, and it became necessary to remove the track from the south side of "Spionkop," disconnecting it at Station 2 + 71 and resorting to filling. in the quadrant of a circle, as was done on the east side. This continued until Station 1,093 was reached, when trestling was used, as shown in Fig. 2. The height of the trestling, however, was reduced 20 ft. by having a number of teams build earth bases before its construction was commenced. On Aug. 1 the narrow-gage track was laid through the rock cut on the top of "Spionkop," and the first bent of temporary trestle for the upper and final lift was erected. Fig. 2 shows the condition of the work on Sept. 1; "Spionkop" being on the extreme right, the first trestle to the left being to grade, the second 30 ft. below, and the one on the extreme left, coming from the shovel on the east side, 60 ft. below grade. Dec. 1 saw this gigantic bank of 475,000 cu. yds. completed. This fill is to take the place of a bridge on the main line 127 ft. high. The writer did not agree entirely with the foregoing method of construction, as it was productive of much expense, annoyance and delay. He is of the opinion that had a line been built around "Spionkop" on the 7,790-ft. contour with trestling from the first, it would have been found much more expeditious and less expensive; however, he was overruled in the matter at the time, but since then has had the poor satisfaction of having the contractors tell him that they regretted not having adopted his plan.

carefully measured to the first and a point set beneath it in the floor of the shaft; the second was allowed to remain suspended as a foresight. Right angles were then turned and an offset line 4½ ft. south of the center was run along the floor of the headings in both directions. For the center, points in the roof were then set from this line, and plumbs suspended from them. For a check, as 3 ft. to the north would clear the obstructions east of the shaft, an offset line at that distance was run across it, and the two plumbs suspended with 6 ft. between them, a point being taken below one; the other remaining suspended, as before, for a sight. A 3-ft. offset line was run along the floor of both headings, and the points in the roof, previously set, were checked from this. These points checked fairly well, and were thereafter used to prolong the line when necessary. . . .

On one occasion, the instrument man declared that nothing more could be done, as the cross-hairs had slackened so badly, from the surrounding moisture, that he could not set a point within ¼ in. Something more had to be done, as it was imperatively necessary to set a center ahead; so, in desperation, the writer picked up a couple of candles and placed the flame under the diaphragm of the cross-wires. This dried and straightened them up, and, with occasional applications of the candle flame, the work proceeded.

On July 6 the heading east from the west portal at Station 978, was started, and on Aug. 23, at Station 981 + 37, it met the heading being driven west from the shaft. The center line was then carefully checked up and was found to be exactly correct at Station 984, at the bottom of the shaft; while, where the two headings met, it was found that the line from the shaft was precisely 1 in. too far north, showing that a slight angle had been obtained in dropping the plumbs.

On July 26 the heading west from the east portal was started and continuously driven night and day until on Dec. 8, at Station 988 + 37, it met the heading driven

cavating the deep rock cut at the hill dubbed "Gibraltar." This was a peak of solid granite, 70 ft. above the grade line at the highest point. Operations commenced by running a 3 × 4 ft. tunnel along the center line and at grade for 50 ft. An ell, 20 ft. long, was then drifted to the north, and charged with 8,750 lbs. of powder. This excavation was completed on Nov. 1. On May 24 Cushing & O'Keif began on their 110,000-yd. embankment, 900 ft. long, and finished it on Oct. 20.

On June 16 the Beaumier Contracting Co. started on their 60,000-yd. excavation, 86 per cent. of which was solid rock, and finished it on Dec. 31. On May 10 Mahoney Bros. started on their sub-contract, and will probably finish in February, 1901. Nearly all their excavations have been through the very hardest granite, and considerable difficulty has been encountered in moving it, on account of the immense amount of drilling necessary before the steam shovels could properly handle it. All the shallow excavations between Stations 907 and 925 consist of hard granite, and the roadbed being 47 ft. wide, on account of sidetracks, made it very difficult; however, it was well handled. On July 31 Mr. Smith began by drilling holes 4½ and 5 ft. apart all over the surface, and on October 15 had finished the entire 18 stations.

Out of 1,250,000 cu. yds. to be moved on the four miles, only 12,000 cu. yds., exclusive of the tunnel, remained on Dec. 31, 1900.

The specifications admitted of but two classifications, "Earth" and "Rock." All that could not be ploughed with a No. 1 breaking plow and six horses had to be classed as solid rock. To draw the line between the two was sometimes very difficult.

The writer does not claim anyth'ng extraordinary about this work, except the wonderfully short time in which an immense amount of railway grading can be accomplished with modern appliances and methods under difficult and discouraging conditions. One of the greatest

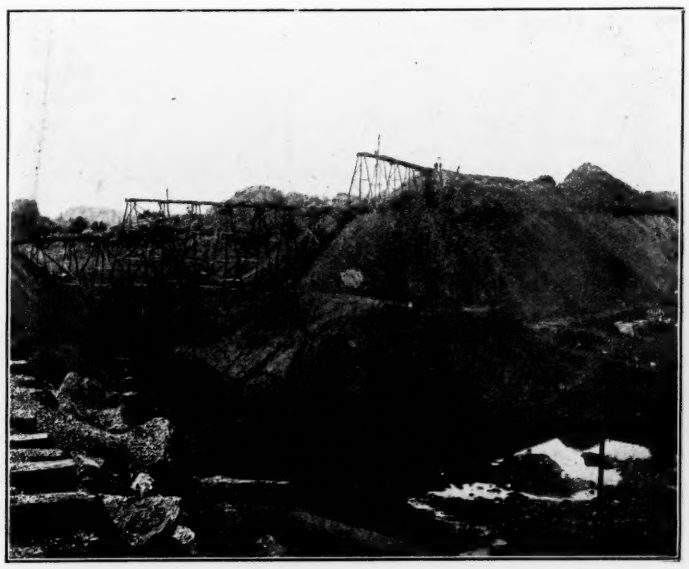


Fig. 2.—Dale Creek Fill, Union Pacific Railroad, in Wyoming.

Fig. 3.—East Approach to Sherman Tunnel, Looking West.

On May 7, work was begun on a shaft for the tunnel at Station 984, and was continuously prosecuted, night and day, through the solid granite, until on June 13 a depth of 65 ft. was reached, 5 ft. below the springing line of the arch. Here the first difficulties and anxieties of the engineers in charge began, for it now became necessary to set grades and centers for the two headings; one working east, the other west. The writer had no suitable instruments, the best being an ordinary Gurley's plain transit, and a 20-in. level. He also had two 50-ft. metallic tape lines, and two 1-lb. plumb-bobs of cast-iron, having points ⅛ in. in diam. Placing two 3 x 12-in. planks securely over the shaft, two nails were set on center and partially driven. A wire, fastened at each end to the nails, was then stretched across, and the two plumb-bobs were suspended therefrom. Two holes, one on each side, were then drilled 1 ft. above the crown, two wooden plugs were inserted, the plumbs were again droppd and two nails set. For elevation, two metallic tape lines were tied together and the elvation was measured in from a bench set at the edge of the shaft and checked by means of a wire measured to exact length over the level rod. Hoisting engines, gallows frame, and blacksmith shops were soon erected, and in a short time the center line was completely obstructed, so that when the headings were driven about 75 ft. on each side, and centers had to be reset, the first having been blown out, it became necessary to use an offset line. This, the writer disliked doing, owing to the poor character of the instruments at hand; however, it was imperative and he had no choice in the matter. At Station 992, east of the shaft, a right angle was turned and an offset line 60 ft. to the south established, and carefully checked in on a point at Station 982, to see that it was parallel. A point was then established opposite the shaft and a line run across it at right angles to the direction of the headings. Two nails were again set, a wire stretched between and the two plumb-bobs dropped 9 ft. apart. A distance of 55½ ft. was east from the shaft. Work on the latter heading had been stopped on Sept. 26, after being driven 437 ft. At that time the force was put on the bench. The entire time occupied in driving the headings is shown in Table No. 2.

Table No. 2.

	Days.	Number of feet driven.	Average rate, in feet per day.
West Portal	49	337	6.88
West Shaft	72	263	3.65
East Shaft	106	437	4.12
East Portal	139	763	5.49
Totals and average..	366	1,800	4.92

Usually, six drills on three columns were worked in the headings, the cut being drilled 8 ft. and the round 10 ft. The most difficult and treacherous rock encountered was between the shaft and the west portal, and all this part will have to be timbered; while from the shaft to the east portal the material was very firm. The bench was taken out in two lifts, and the progress has been as shown in Table No. 3.

Table No. 3.

	Days.	Feet.	Average rate, in feet, per day.
West Portal	92	373	4.06
West Shaft	91	227	2.49
East Shaft	97	453	4.67
East Portal	51	180	3.53
Totals and average..	331	1,233	3.73

Much time was lost between the completion of the heading and the starting of the bench at the west portal, as the entire heading had to be slowly and carefully timbered. As shown by the foregoing figures, 567 ft. of bench yet remain to be taken out, between the shaft and the east portal; this, at the present rate of progress, will require about 70 days' more time. It is hoped, however, that this estimate will be materially reduced. . . .

On May 22 Roman & Scott, with a force of 11 men, about all that could be worked to advantage, began ex-

annoyances to which the contractor is subjected in this section is the worthless, thriftless class of men he has to depend upon for labor.

Sections 18, 20 and 21 were entirely finished on Dec. 31, 1900, and final estimates were rendered. On Section 19 Mahoney Bros. still have about 12,000 cu. yds. to move and some sloping to do. Beaumier has to do some slope trimming, and not quite one-third of the bench in the tunnel has yet to be moved, while in the east approach about one-half the slopes have to be trimmed up and the cut ditched—the latter being difficult, owing to the frozen condition of the ground.

A profile of this division is shown in Fig. 1. From the start to the present time the forces, reduced to a unit of one day, have been as shown in Table No. 5.

Table No. 5.

Contractor.	G. C. Smith.	Mahoney Bros.	Beaumier Contracting Co.	Kilpatrick Bros. & Collins and Wood Bros.	Roman & Scott.	Cushing & O'Keif.
Men.						
Foremen 230	1,046	704	6,854	203	240	
Laborers 2,115	13,710	10,354	50,922	1,117	1,957	
Drillers 385	1,850	527	7,625	307	....	
Machinemen ... 116	1,712	1,364	19,243	....	....	
Trainmen	1,488	....	7,263	....	....	
Totals 2,846	19,806	12,949	91,907	1,627	2,197	
Teams.						
Scrapers 920	1,016	452	4,854	9	2,952	
Carts 134	....	....	....	216	....	
Plows 144	235	77	610	....	295	
Wagons	305	....	520	....	....	
Cars	24	839	1,521	....	107	
Totals 1,198	1,580	1,368	7,505	225	3,354	

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The Committee on Graduation of the American Railway Engineering and Maintenance of Way Association (by the way, cannot the human intellect improve this title now while the society is still young?) suggests conforming slopes to nature. "Slopes of cuttings and . . . embankments, when they attain their permanent set, are not . . . planes, but more or less curved—a rounding off at the top and a curving out at the foot. . . . This being the ultimate natural result . . . it is best at the outset . . . to further its attainment by rounding off these angles." About 20 years ago we considered this subject for two or three hours and dropped it. Probably we did not think enough about it. Obviously it would be practicable to plat the sections of a number of old banks and so get a mean curve which would be approximately the permanent curve; although strictly there is no permanent curve, for Nature will gnaw away at any unprotected slope till the bank is levelled. Having determined this mean curve it would be possible to set it out and have your bank built to it; but would it pay? Would it not be cheaper to make the bank as we now do, and let Nature put in the curves of stability? A bank bounded by the curved surfaces which Nature eventually establishes is more beautiful than a bank bounded by plane surfaces, and will stand better; and if we are going to sod the new bank perhaps we had better build it in its final shape; but who would sod a new bank? The instability of a new bank is more than skin deep. But perhaps 20 years of incubation has not hatched the chick of wisdom (as Kipling might say, but probably would not,) and we do not presume to differ with the distinguished committee; we merely ask a question or two. The committee's suggestions about protecting slopes we have read with great interest. The waste from unprotected slopes is in destruction of banks, in the cost of clearing ditches and surfacing track as a result of choked ditches, and the aggregate of this waste is enormous. The ugliness of bare and crumbling slopes we need not mention now. As a people we do not care much about that side of things yet, and so we may wait another 20 years before we take up the aesthetics of slope protection and the money value of a tidy, not to say handsome, right-of-way.

Telephones in Train Despatching and Other Railroad Work.

In everything except the transmission of train orders, the telephone appeals to the railroad officer just the same as it does to any other business man; and probably every railroad now makes some use of it. The reader will recall that a vice-president of one of the companies in the Pennsylvania system said, two or three years ago, that the long distance telephone had enabled him to stay at home twice as many days in each month as formerly; had relieved him of ten out of the twenty hotel or sleeping-car nights which formerly fell to his lot every month. The Pennsylvania and the New York, New Haven & Hartford now make use of long distance connections and of exchanges in their own buildings to such an extent that the saving in time enjoyed by this vice-president has been made available, perhaps, in a lesser degree, to many other officers. The New Haven has four large and a half-dozen smaller exchanges under its own control and two of its superintendents have telephone wires running out long distances on their respective divisions. The Pennsylvania, with its more extensive railroads, has a correspondingly larger telephone equipment. Other railroads use telephones extensively but none, that we now recall, so extensively as these two. Those which do not use them, both for short and long distances, where valuable economy of time can be effected, are simply ignoring a lesson of every day experience. It is true that the telephone companies' prices are high; but the railroads, with their rights of way, and interest in pole lines, are in the best possible position to secure reductions in cost.

Our attention has been called to this subject by hearing that one company that put in some telephones along the line of its road subsequently took them out, for the reason, ostensibly, that the officers could not use the 'phones without being annoyed by interruptions by persons at way stations. In another case a freight traffic office adopted a rule to give no quotations of rates over the telephone, presumably for the reason that he could not be assured of accurate transmission. In both casese a more plausible explanation is "leakage." It can hardly be that reasons like these will prove permanent deterrents; but the incidents serve to show how the telephone problem is looked upon by railroad men in some cases. To prevent improper use of instruments at stations is a matter of discipline. Some superintendents are unable to maintain discipline on a telegraph wire; operators fight for circuit and the despatcher is not properly respected; but the fault is not with the telegraph. To refuse to quote rates over the telephone must sometimes mean to lose business. To make sure that your message is accurately received does require care; but so does everything else important.

The question of accuracy brings us to the problem of using telephones in sending train orders. This branch of the subject was discussed in a lucid article in our issue of January 4, page 9, from a prominent officer of a well known road, signing "G. F. D." He called attention to the fact that telephones now give satisfactory service, defects and objections which existed a few years ago having been done away with; that they work in bad weather, whereas telegraph lines now, as always, are troublesome in rainstorms; that the repetition of messages, under suitable regulations, provides the necessary safeguard against errors in transmission, and that experience on certain roads in Pennsylvania and elsewhere proves the correctness of these statements. Transmission by telephone gives one advantage which the telegraph does not; a message can be received by a train conductor, written out by him, handed to the engineman and repeated back to the despatcher by the engineman. As no special training is required to send and receive by telephone, train orders can be sent to stations or meeting places where no station agent or operator is on duty. This experience of 1901 only confirms the assertions concerning the utility of the telephone in train movement which were made by Mr. Hammond in the *Railroad Gazette* in 1892 and 1899.

It is true, as was remarked by "G. F. D.," that the use of the block system will be pretty sure to gradually relax the rigid rules which now surround the transmission of train orders. On double track this relaxation has already taken place in a number of cases; and where the block system is used on single track, a clear headed superintendent soon sees that even meeting orders need not be repeated. The superintendent who, with block signals, does not feel safe in abolishing repetition and other safeguards may well ask himself what his block system is good for. But some 100,000 miles or more of American railroads are still being worked without the block system; and if there is any money or work to be saved by introducing telephones, these roads, being poorer than those which have the block system, are the very ones which most need to avail themselves of the saving. They will not be frightened by imaginary difficulties in repeating telephone messages or assuring their accuracy.

We do not need to repeat our correspondent's argument. His statements are based on intelligent experience and on careful study of that experience. We wish only to call attention to one point in which many superintendents will differ with him. He says that from the standpoint of safety telephone despatching leaves little to be desired. This is true, provided proper discipline is maintained. If your conductors and enginemen already have the habits of carefulness which are learned from long experience in handling trains, if your station men have been trained to strict and intelligent obedience to orders, this position is sound. But the superintendent has to consider things as they are; and many superintendents are influenced by the fact that there is a percentage of indifferently trained men among their force on whom they must depend for accurate work. In other words, in spite of effort in the past to maintain and increase the efficiency of his men, the superintendent realizes that his discipline is still considerably short of perfect. To make any change in the regulations will require a long course of instruction and testing.

With this feeling prevailing everywhere, it is not surprising that the telephone grows in favor slowly. The feeling that the service of telegraph operators costs but little if any more than that of telephone operators who will be competent in other respects to do railroad work, has an influence in the same direction. The fact that any change, if made, would probably have to be partial or experimental is also a hindrance. For long distances the telegraph should, no doubt, in many cases be retained, on account of the high cost of the telephone; in such a case the use of telephones for short distances would introduce a slight element of complication.

We do not state this superintendent's argument, however, for the purpose of espousing it. If there is no objection to the telephone except the difficulty of carrying out the change, the objector has the burden of sustaining his position. The elements of the cost of a telephone "train wire" should be studied, and determined in detail, for it is quite probable that some of these elements may soon be cheapened, so that what is too costly or troublesome this year may not be so next year. Where discipline is at all doubtful it is fair to ask whether an improvement should not be made, whether a change be contemplated or not. A person who cannot be trusted to exercise necessary care in making a telephone order correct and "complete," must be of doubtful trustworthiness in any sphere.

There is one point in the comparison between telegraph and telephone which G. F. J. did not touch upon, and on which no other telephone users have as yet enlightened us; that is the adjustment of speed as between the sender and the receiver. With the telegraph, every receiver has been trained to work at a speed corresponding to that of the sender, and every sender must adjust his sending to the capacity of the receiver. This training is often defective, and there is always more or less friction between fast senders and slow receivers; but, broadly considered, the speeds are substantially equal; good Morse sending corresponds to good pen writing. Now, as train orders must always be put in writing the speed of the average penman limits the speed at which they are sent (the use of automatics or "rapid" apparatus is, of course, not to be considered in the present discussion); and the telephone therefore has no advantage in its greater speed. You must not speak an order any faster than it can be written down. But just here is a difference; the telegraph operator *normally* sends slow enough to accommodate the receiver, while the oral sender *normally* sends two or three times too fast. This tends to irritate the sender and to hurry the receiver. Every telegraph operator and everyone who dictates to a stenographer knows how this condition of things causes mistakes.

A repetition will correct mistakes, and the fact that there is friction in dealing with train orders is no excuse for delivering an order with an error in it; but the fact remains that this feature of the work will require careful attention from any superintendent who adopts the telephone for train orders and who aims to establish a thoroughly efficient service.

In repeating a message the telephone should be quicker than the telegraph, for the words can be sent over the line as fast as the man at the other end can write a line under the words on his copy, one by one. This means a saving of perhaps half a minute on each order; not a great saving surely; but one oftentimes appreciable.

The advantages of the telephone in despatching trains may be summarized as—

1. It makes available as an operator every station and train employee who is good at reading and writing.
2. As a corollary to this, makes it much easier to promptly fill vacancies.
3. A slight saving in time.
4. Perhaps, a saving in wages.
5. Enables the despatcher to make sure that both conductor and engineman have read an order.

To these we may add, if the discipline is of the kind

that we have mentioned, a compulsory improvement in discipline.

The only permanent disadvantage is the cost. For long distances the telephone requires a metallic circuit of copper wire. Whether this will be a real disadvantage of any consequence remains to be shown. Some one has said that it is very wearing on the nerves to record telephone messages all day; but, assuming that this is an appreciable drawback, it is safe to say that some way will be found to cure it. The first advantage speaks for itself; this alone will, we think, be a determining factor in an increasing number of cases. The second includes an added element of strength in dealing with strikers; though it is to be borne in mind that this very fact may bring on strikes of operators. The third advantage is appreciable in the despatcher's office, but the saving in the time of the trains affected by any particular order is of only occasional value. The fourth item cannot be a very important one (except where a telephone can be made available without establishing a station or office) for the reason that the wages of Morse operators are generally no higher than must be paid for non-operators who are of sufficient years and trustworthiness to handle train orders. It will be a decided backward step if the introduction of the telephone leads to the employment at stations of persons, in any capacity, of lower general intelligence than those now employed. The fifth advantage is based on a single detail, but it is not unimportant. Enginemen have many times smashed their engines by depending on the conductor's reading of an order.

Annual Reports.

Missouri Pacific.—The past year has been an eventful one for this company as regards its gains in receipts and tonnage; in the extent of the financial changes carried out, practically completing plans which have been in progress for several years past, and in the progress made, following well worked out plans, in reducing the cost of moving freight. All these things have been reflected in increasing credit as well as in the changes brought out in the annual report now at hand for the year ending December 31. These changes having apparently prepared the way for the company to resume dividend payments, which were suspended in 1891, and financiers evidently believing that the Southwest is to witness further striking illustrations of the recent consolidation movement, Missouri Pacific securities have been among the most active on the Stock Exchange for months past. The stock has nearly doubled in quotations since the issue of the annual report for 1899 and at present, though it pays no dividend, it is selling within a few points of par. In this same month in 1897, it may be recalled, the shares were selling at but $15 a share.

Revenue changes of the year show plainly new forces operating in favor of the Missouri Pacific. The increase of gross earnings, $2,431,500, though large in itself, 8¾ per cent., is not materially above increases reported in previous years since 1896. The more noteworthy fact is that so large a proportion of this gain in gross was retained as net revenue, the expansion in expenses being only $226,000. The increase in net is thus $2,205,400, equivalent to 26 per cent. The aggregate revenue was much in excess of any previously reported, gross income being $30,511,313; operating expenses were 65 per cent. of this, against 70 per cent. in 1899; and net earnings were $10,653,146.

Exceptional receipts and charges, mostly in connection with refunding and other purely financial operations of the past two years, make comparisons and even the actual figures of other items in the income account more or less misleading. It need only be stated that the net surplus on the stock is reported for 1900 as $3,386,760, as against $640,926 in 1899. In the former year, however, over $913,000, representing discounts and commissions on bonds sold and other expenses of bond refunding, was charged into the expenses of the year, decreasing the surplus by that amount. Last year's surplus also was decreased about $300,000 by operations of the same character.

As the surplus stands, however, it is equivalent to about 6¾ per cent. on the outstanding capital stock of $50,423,000. As in previous years nearly all the increase in revenue came from freight traffic. But whereas in earlier years the Iron Mountain lines yielded the greater proportion of the gains, though the mileage is little over half that of the Missouri Pacific lines, the latter in 1900, on gross receipts of $15,930,000, shows an increase of $1,656,600, as against a gain of $774,917 on the Iron Mountain. Another factor contributing to the higher revenue of the year was an increase in average freight rates as well as in passengers and in tonnage carried.

Changes in the character of tonnage, however, and in growth of local business, seem to account for the higher average rate reported rather than an actual increase in rates, although this factor must have operated to some extent. As a matter of fact, the slight increase of 7-10 of a mill in the average ton mile rate, which brought the figure up to 8.7 mills, a gain of 9 per cent., was due altogether to the larger local average rates, an increase of about ½ mill in that item, more than making up a decrease in rates on through business. Of the total increase reported in gross receipts, $2,431,500, freight earnings account for $1,927,653, and of this figure $1,467,000 is accounted for by larger local business.

Missouri Pacific expenses are not divided according to the Interstate Commerce Commission's form now in general use in the United States, but under the older form of five classes. These show as their most striking feature a decrease of $183,303 in transportation expenses. Vice-President Harding, who took charge of the operating department early in the year, attributes the improved results of the year largely to better car loading and to a larger use of the company's cars on its home road; though improvements in grades did their share. The final results in the train statistics was an increase of 196,800 in miles run by passenger trains and a decrease of 475,756 in miles run by freight trains. The average train load was increased by 28 tons, or 13 1-3 per cent., to a total of 239 tons on the entire system. The average on the Iron Mountain lines is 270 tons, and the gain in the train load on those lines, where important grade reductions have been carried out in the last year or two, was 35 tons. This decrease in train mileage, it is to be noted, was despite an increase of 2,420 millions, or 8 2-3 per cent. in the ton miles. With this saving of train mileage combined with the higher rates, freight train mile earnings rose to $2.14, or over 14 per cent. above the figure of 1899, viz., $1.87.

Though the changes in train mileage are measured by comparatively small figures, they represent heavy re-adjustments in car mileage. Thus, during the year the mileage made by private line cars decreased over a million, or 3 1-3 per cent.; the mileage of other foreign cars decreased nearly four millions, or about 12 per cent., while the mileage made by Missouri Pacific cars on its own lines increased 10 1-3 millions, or about 6 per cent., leaving a net increase in car miles of five millions. The more important of these statistics follow for the last two years:

	1900.	1899.
Tons moved	11,126,375	10,206,910
Tons one mile	*2,628,457	*2,419,582
Passengers moved	4,941,764	4,250,046
Passenger miles	237,867,800	229,160,700
Av. freight train loads (tons)	239	211
Freight train rev. per mile	$2.14	$1.87
Ton miles, cts.	0.834	0.827
Freight train miles	10,993,900	11,469,600
Passenger train miles	6,793,700	6,596,800
Freight car miles	245,620,700	240,529,200
Passenger car miles	35,818,000	35,123,400

*000 omitted.

The company has under contract 80 heavy locomotives and 2,000 freight cars, and with these in service early this year, together with progress made on important roadway improvements, reducing grades, much better progress is expected in working out the train and traffic problem. Of this work in the past year it may be pointed out that grades were revised on 48 miles; new heavier rails laid in 139 miles; over 50 miles of side and passing tracks constructed at a net cost of $105,700; 40 miles of track ballasted, while expenditures on bridges and buildings were $1,100,000, about $124,000 more than in 1899.

Of the financial changes of the year, the increase of the capital stock by $2,983,500 in exchange for bonds and stock of the Kansas City Northwestern may be mentioned, together with the issue of $12,000,000 new debenture 5 per cents. These were issued for the following purposes: 5 per cent. gold funding notes of 1895, $6,712,000; to pay and satisfy loans payable, $1,067,969; to retire equipment trust notes, $2,462,040, and for partial payment of capital expenditures, heretofore paid out of income, $1,757,991, leaving $613,133 to retire equipment trust notes as they mature and a reserve of $3,000,000 (not issued) for future improvements. The other changes in funded debt were mostly on account of refunding.

The express train from Moscow to Irkutsk, over the Siberian Railroad, which for a year or two past has been despatched once a week, before that once in two weeks, runs now twice a week. During the year ending with July, 1899, this train carried in all 4,517 passengers; during the following year, 5,493; but in that year the number going through from Moscow to Irkutsk was only 1,807, or an average of 18 in each weekly train. The train consists of one first class, two second class, one dining and one baggage car, with only room for 66 passengers (all must have berths). The official journal of the Ministry of Finance complains that the train does not begin to pay expenses; which, however, must have been known when the absurdly low fares were fixed; absurdly, that is, from the point of view of immediate profit. The ultimate value of the road depends on the development of Siberia; which itself depends not only on immigration, which will not use the express train much, but also to a very great extent on the ransacking of the country by the agents of capitalists, Russian and other (especially other) in search of opportunities for the establishment of profitable mining and other industries.

The Illinois Central Railroad is doing some special work in educating the people along its line as to the possibilities and value of better roads. A train is to be sent north from New Orleans to Chicago to give object lessons in road building. At a number of places the train will stop and pieces of model road will be built. Arrangemens will also be made for public meetings for discussing the matter of better roads. This is an enlightened procedure and is almost certain to ultimately return to the railroad company a good interest on the money and energy invested.

NEW PUBLICATIONS.

A Text Book on Field Fortification. By G. J. Fiebeger, Professor of Civil and Military Engineering, United States Military Academy. Octavo, 166 pp., plates and maps. Index. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1901.

In these days every intelligent American is interested in the art of war, and some who are not very intelligent think about war without bothering themselves about the art. But, especially, numbers of young engineers have an interest in the more scientific side of war such as has not been known in this country since 1865, for they see the more or less close probability of being called on to serve as line or staff officers in the army or in the National Guard. We are not among those who deprecate this interest. For good or for evil, our country has assumed relations which make war far more possible than it has been for many years, and the better prepared we are for it the more likely is it to be averted, or if it comes the quicker and more certain will be our success in it. Therefore this peaceful "Journal of Transportation" ventures to call the attention of young engineers to Col. Fieberger's admirable little book. War is essentially engineering, and it is peculiarly fit that the young engineers of the nation should prepare themselves for military duty in the field if the nation should need them.

Field fortification deals with the construction, adaptation and use of all sorts of temporary defenses when troops are actually in the field. It includes not only positions for artillery and regular lines of earthworks for infantry, but also those little crescent shaped hollows which we used to dig in the Civil War under the name of "picket pits," and the defensive uses of houses and walls and in short the best adaptation of all sorts of cover. But to contrive and use cover the soldier must know the range and power of arms and something of the customary ways of handling troops in battle; so a book on field fortification properly covers a pretty wide range of knowledge. Col. Fieberger gives in detail the accepted ways of making and using field works of all classes; describes entanglements, mines and other obstructions; describes the defense of buildings, villages, etc., and treats of the passage of rivers and of encampments and communications. But probably the general reader will find the greatest interest in the illustrations of principles and methods from actual operations in the field. These illustrations are drawn from our Civil War, from the Franco-German war, from the magnificent defense of Plevna, and from the Napoleonic wars. These are illustrated by eleven maps. Doubtless the same general reader would be astonished to know how many of the new arts and principles which the newspaper correspondents have lately discovered in South Africa were known and practiced in the Civil War; to learn, for example, that a front attack on an intrenched line, well held, even with muzzle-loading rifles, was found to have little chance of success; and to learn that low wire entanglements were used by General Gillmore (Corps of Engineers) in 1863.

Roadmasters' Association of America.—The Proceedings of the 18th Annual Convention of the Roadmasters' Association of America, held at Los Angeles, Cal., last November, are published in a pamphlet of 148 pages. This may be had from the Secretary, Mr. J. B. Dickson, Chicago & Northwestern Railway, Sterling, Ill. The pamphlet contains the several addresses delivered at the convention, also communications, papers, discussions and reports, together with the general routine business. The 19th convention will be held at Washington, D. C., Oct. 8-10, 1901.

The Law of Operations Preliminary to Construction in Engineering and Architecture. Rights in Real Property. Boundaries, Easements, and Franchises. For Engineers, Architects, Contractors, Builders, Public Officers, and Attorneys at Law. By John Cassan Wait, M.C.E., LL.B. Octavo, 700 pages. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1900. Cloth, $5.00; sheep, $5.50.

The purpose for which this book was written is praiseworthy. The author has appreciated the opportunity which may come to the lawyer, promoter, business man or engineer to become the responsible head of some large enterprise or corporation, and he has gathered together numerous instances where the principles of the law of contracts and of property have been applied to a certain portion of the environment in which the engineer works. As all construction in engineering has to do with lands and rights connected therewith, a large part of the book is devoted to a discussion of titles in land, ways, surface and subterranean waters, light and air, boundaries, lateral support, and all kindred rights which may be affected by such construction. Some attention is given to the method of obtaining these rights, the acquisition of them by corporations, and the nature of corporate franchises. These subjects ordinarily are considered by the employer of the engineer, acting under the advice of counsel, before the services of the engineer are needed. For these reasons the book will be of little assistance to the engineer in his professional work, but may help to point out to him the legal obstructions in the way of actual construction.

The author, however, seems to hope that his book will afford a short cut whereby legal advice may, as a rule,

be dispensed with. He states in the preface: "An engineer cannot take time to instruct a lawyer in the mysteries of science and mathematics, and place before him a lifetime's experience, to enable him to determine some simple question in law, which principles of law can be acquired by a few moments leisure reading on the law of property and contracts. With the engineer rests the obligation of making this combination, for lawyers will not. The technical training should be united with a liberal knowledge of the law of property and contracts, so that the determination may be the result of one effort, by one mind, and to one end and purpose." To accomplish adequately what the author here desires requires an extended treatment of the law, and in his desire to give all necessary specific information regarding particular instances which have come to his notice he has failed to discuss the principles of law, without an understanding of which the untrained mind can never hope to make the combination desired by the author.

The lawyer is certain to find much that is useful in the book, despite the fact that it was not written primarily for him. As an exposition of the law of property, or of the law of contracts, or of corporate rights and the method of acquiring them, all of which have elsewhere been specially treated at great length and thoroughness, it will not commend itself to the profession; but of those instances where discussion has been had or adjudication made of the legal problems which engineering construction involves, it will be found to furnish a valuable digest of cases which the lawyer, desiring to save time and labor, cannot afford to ignore. The paragraphs are short and have intelligent headlines in large type, while the index is cross-referenced. The practical value of the book would be increased had the author written somewhat at length upon methods of procedure, especially where conflicts of jurisdiction arise as in the case of international bridges and kindred structures.

The Railway Purchasing Agent's Directory. Octavo. Cloth. 442 pages. Indianapolis, Ind.: The Railway Equipment & Finance Co. 1900.

This is the first number of a book which it is proposed to issue twice a year containing "directions where to purchase every article used in constructing and operating railroads; also a list of railroads with the name and address of officials in charge of purchasing departments." The classified list of manufacturers occupies 383 pages and apparently is very complete and has been compiled with a good deal of care. The list of railroads and purchasing agents is given in 16 pages and the remainder of the book is taken up with an index of supplies with references to the pages of the classified index where the several items appear.

Moulder's Text-Book.—Being Part II of American Foundry Practice. By Thomas D. West. Eighth Edition. New York: John Wiley & Sons. $2.50.

The titles of books on practical subjects by practical men often remind us of the title of the history referred to by Macauley, which was as long as an ordinary preface, and the full title of this book is of that sort; but the book itself is not like the history in proportion, as it is of ordinary handy size, well bound, with letter press plates and illustrations, inexpensive but distinct. The promiscuous—or more correctly, the absence of—arrangement reminds us not inaptly of the general appearance of a foundry as you see it at a first glance; but there is a certain interest in the easy manner in which the subjects are treated, which should attract the attention of the moulder and foreman. There is a consecutive, thorough treatment of only a few subjects. We find no elaborate advice as to mixtures or economies, no technical discussion of pattern designing, and we look in vain for articles upon subjects like malleable iron stove castings. But the book is an assemblage of good articles full of practical hints on such subjects as the principles of moulding practice; that is work, and the elements of geometry for the moulder; the use of moulding machines and on the moulding of cylinders, or propeller wheels and of hydraulic hoists, and upon cores and other subjects, all illustrated; and if anything is missed it may be looked for in the first volume of this series on American Foundry Practice. The articles on the merits of "bedding in" and "rolling over," weighting cores, on facings, on pouring gates, on cupolas, tuyeres and blast pipes, on coke and coal for cupolas, are all short and lively. There is an absence of exact information, although there are a few tables such as that of cupola and tuyere areas and also of equivalent areas of pouring gates which are compiled from practical examples and experience. There are 46 statements of American cupola practice giving actual figures of the dimensions, mixtures and products of as many cupolas in different parts of the country, signed by the foremen. The most elaborate treatment of any one subject is of foundry cranes and crane work which occupies 56 pages. Perhaps the most valuable article to the engineer is that on the foundry addition, ovens and pits, as illustrated by on the foundry of the Cuyahoga Works, Cleveland, Ohio, where the author had a long experience under the late and lamented Mr. J. T. Holloway. The general style and thought of the book is more suited to small operations than to large works, as it seldom refers to cost or economies or waste; but it is an excellent example of the foundryman in print. The new matter in this edition consists in part of two papers on "Sound Castings" and "Defects in Structural Castings," read before the Cleveland (Ohio) Engineers' Club, and other matter designed to cover the changes of thirteen years.

Ballasting.

The Maintenance of Way Association's Committee on Ballasting (Chairman, F. T. Hatch, Superintendent Terre Haute & Logansport Railway, Terre Haute, Ind.), presents a short report prefaced by an apology for the small amount of work done. The committee had to be reorganized because of the necessary resignation of two successive Chairmen. We give a few extracts.

Mr. Feldpauche, Principal Assistant Engineer Pennsylvania Railroad, in his report made to the International Railway Congress [*Railroad Gazette*, p. 473, 1900,], says: "By way of introduction, it would seem appropriate to assert that good ballast should consist of such materials as would best insure a substantial, enduring, dustless and somewhat elastic foundation for the track. It should be substantial, so as to distribute the strain of passing loads upon the largest possible area over the underlying roadbed, thereby reducing to a minimum the depressing tendency of ties. It should be enduring, so as to lessen, as much as possible, its destruction from tamping and the expense thereby entailed for its removal. . . . It should be dustless, so as not to discomfort the passengers or heat the frictional parts of the running equipment. Finally, the ballast should be somewhat elastic, so as to lessen the shocks and thereby reduce the wear and tear upon rails and trains."

Mr. Bauchal, Assistant Permanent Way Engineer of the French Western Railroad, in his report to the Congress [*Railroad Gazette*, p. 76, 1901,] defines the functions of ballast thus:

"First—It gives the track a suitable support and fills up inequalities in the formation level.

"Second—It distributes the pressure upon the formation level and reduces the pressure per unit of area.

"Third.—It acts as an elastic support to the track.

"Fourth—It resists the lateral displacement of the track, both through its mass and through friction.

"Fifth—It resists longitudinal displacement of the track.

"Sixth—In case of certain formation levels, it acts as a protection against frost.

"Seventh—It protects the wood (presumably of the ties) against excessive dryness or excessive dampness."

Our own Chairman, in his report to the Association a year ago, said: "Ballast may be defined as the material above the roadbed, in which the cross-ties are imbedded, and its object is to get a solid and uniform bearing for the cross-ties to distribute the applied load over a large surface of the roadbed to hold the cross-ties firmly in position, to give elasticity to the track and to allow the water to pass off freely, thus avoiding churning in wet weather and heaving by frost."

None of the foregoing descriptions of ballast and its functions, except that of our former Chairman, say anything about drainage, which we believe to be one of its most important functions. There is one word used in all these definitions that we do not think to be well chosen. That is "elastic." Elastic means something springy, and we certainly do not want that in our track. The condition desired is that it shall not be rigid or unyielding, but shall be to some extent flexible or pliable. We believe "pliable" more nearly describes the condition we desire, and will use that word hereafter instead of elastic.

Your committee will not, at this time, attempt to describe an ideal ballast, but simply what the materials must be and do to fulfil the primary requirements. To be ballast, it must be substantial, so as to distribute the applied load. It must be enduring, to resist as far as possible destruction from tamping. It must be pliable, to diminish the shock and consequent wear of track and trains and permit of easy manipulation in lining and surfacing; and it must, above all things, provide thorough drainage. Earth or dirt will fulfil none of the above requirements, and we do not think it should be designated ballast. We consider earth or dirt ballast to be a misnomer, and that track put up with it be called earth or dirt track. There is another material, used somewhat extensively in the South for ballast, with which your committee is not familiar; that is, cherf. We know it is a variety of stone, but do not know enough about it at the present time to be able to say that it makes good ballast. We will, therefore, leave it out of our category for the present, but will gladly add it to the list if any member will show that it can fulfil the requirements. So far, then, as our present knowledge goes, the only materials which will fulfil the requirements are broken stone, gravel, sand, burnt clay, slag, cinder, burnt shale and chatts. The requirements as to quality, size, etc., and the comparative merits of the different materials will be considered later in the report. . . .

The functions of ballast are: To make a solid, yet pliable and uniform, bearing for the cross-ties; to distribute the applied load over a large surface of the roadbed; to hold the cross-ties firmly in position, and to provide drainage. . . .

Our opinion is that nothing less than 8 in. of ballast under the ties, with the track filled in, will fulfil the requirements even under the best conditions as to roadbed, climate, drainage, etc., and that below this minimum track should be designated as partially ballasted or veneered; partially ballasted, when there is a sufficient depth under the ties but the track is not filled in, and veneered, when the track is filled in, giving the appearance of ballast, but with very little under the ties.

To summarize, then, your committee would report as follows on "What Constitutes Ballasted Track": The term "ballast" shall only apply to broken stone, gravel, sand, burnt clay, slag, cinder, burnt shale and chatts, and the expression "ballasted track" only to filled-in track, with not less than 8 in. of ballast under the ties.

Masonry.*

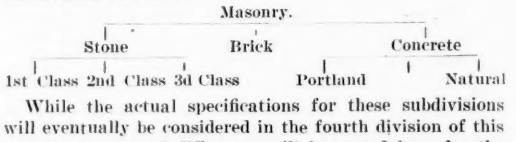
The subject of masonry, as outlined by this committee at the previous convention, embraces the materials used in stone, brick or concrete structures, built for carrying the roadbed and track of modern railroads and structures incident thereto: their design, and the best practice of the present time for securing convenient, economical and durable construction. The term "masonry" will be used to apply to any material laid in mortar—which is the original meaning, but not the present one.

It is recommended, in order to avoid misunderstanding, to qualify the word, particularly in specifications or descriptions where clearness is imperative. In railroad work, "masonry" has undoubtedly, up to the present time, meant stonework only, but hereafter the definition should include brick and concrete work.

In the consideration of the subject, your committee has endeavored to separate it upon the following basis:

1. Classification of the different kinds of masonry.
2. The materials of construction.
3. The economic consideration.
4. The design, including foundations and detailed specifications.

(1.) In the works of reference bearing upon stone masonry, and especially as between English and American practice, there is a wide diversity as to the class of work intended by different terms; notably, the English definition of rubble calls in some instances for a class of work which an American engineer would designate range work or second-class masonry. The possible difficulties liable to arise from such confusion of names has led your committee to recommend the following classification and subdivision of terms:



While the actual specifications for these subdivisions will eventually be considered in the fourth division of this report, the general difference will be stated here for the sake of clearness in discussion.

First class masonry will include all cut stone work, ordinarily coming under the head of arch and ashlar work.

Second class masonry will include all range work, where stones have parallel top and bottom bed dressed to size and laid either in parallel or broken range.

Third class masonry will include all work laid up without regard to range or bed, where stones are shaped to fit entirely with the hammer and where spalls and chips are permissible to secure a bed.

Subdivisions of these three classes may be necessary, but they would be met by specifications and drawings.

Brick masonry will include all classes of brick work, whether vitrified, paving, pressed, or common brick.

Concrete will include all monolithic work, composed of broken stone, or gravel, singly or combined, and laid up with a matrix of cementing material.

(2.) The materials of construction, their characteristics, qualities, distribution and availability, form one of the most important features considered, influencing as they do the class of masonry which the constructing engineer is obliged to adopt.

The materials are stone, gravel, brick, sand, hydraulic cement, asphalt cement and lime.

Stone being the natural product, of wide distribution throughout the country, and the type of construction most generally used in permanent works in the past, we shall consider it first. While the number of geological varieties of stone suitable for masonry is few, their variation in quality and characteristics is very great. From 63 railroads reporting, we find materials used as follows:

Table No. 1

	For Stone Masonry.	For Concrete Masonry.
Brick	12	..
Freestone	3	1
Gneiss	1	..
Granite	16	5
Gravel (single or with broken stone).	..	31
Lava	2	..
Limestone	34	39
Sandstone	35	15
Slag	..	1
Tailings	..	1
Trap	..	4

No stone masonry, 9.
No concrete masonry, 6.

It is notable in these reports that some railroads using sandstone for stone masonry use limestone for concrete masonry, but give no reason for the exclusion of sandstone from the concrete.

The selection of a stone for any definite building purpose is an important matter, to which too little attention has been paid in the past. In determining its value, observation of the stone as found in the quarry is perhaps one of the best methods of judging of its lasting qualities. The comparison of the freshly-cut surfaces with the natural outcrop which has undergone prolonged weathering affords a criterion that cannot be had elsewhere. Observation of buildings and tombstones made of the stone under examination may often give valuable information and be of great aid, but this is liable to be obscured to

*Extracts from the Report of the Committee on Masonry, American Railway Engineering and Maintenance-of-Way Association.

more or less extent by unknown factors. The size of the pores in a rock is a matter of considerable importance. If they are of such size as to allow of rapid evaporation, or to allow such water as may be left in the rock to be extruded on freezing—in other words, if there be room enough for the water to expand—freezing and thawing are not likely to have a very deleterious effect. The essential qualities of a good building stone may, then, in a general way, be said to be a homogeneous and compact texture, a grain not too coarse and constituents or cementing material not readily soluble. It should show a clean fracture and give a clear ringing sound when struck, and, finally, in order that it may not be too expensive, it should be capable of being easily worked.

Concrete.—We come now to the consideration of a class of masonry, the usefulness and adaptability of which to the purposes of the constructor are becoming more fully appreciated continually; its application is almost universal, enabling permanent structures to be built where, for the lack of suitable material, stone masonry is impracticable. In this subdivision of the subject, statistical information is almost entirely lacking, except such as may be taken from text-books.

A comparison of the reports indicates a tendency to increase the strength of the matrix and reduce its volume by the addition of gravel and the use of unscreened stone to assist in filling the voids in the material mass; the stated proportions varying from 1, 2 and 4 to 1, 3 and 6, with gravel added in most cases, but volume not stated; a few report the use of gravel alone without the use of broken stone.

Table No. 1 shows that limestone and sandstone are most generally used, probably on account of the cheapness of crushing, but several lines exclude the use of sandstone from concrete masonry, although using it principally or exclusively for stone masonry; no reason is assigned for this, and your committee suggests that it may be due to local conditions entirely and not to any unsuitable characteristics of sandstone for the purpose.

We find the largest size to which stone is allowed to be crushed to be 2½ in., with the preponderance strongly in favor of 2 in. No information has been received relative to the use of "one-man" stone or rubble blocks in the mass of clear masonry as an element of economy, but such use is quite usual, and we believe it to be permissible under proper restrictions and supervision.

The only data available showing the volume of constituents are contained in the various text-books upon the subject and we have therefore withheld any discussion upon this subject at the present time.

We now enter upon an important feature of the subject which has never been thoroughly treated, but which presents questions of importance involving both physical and financial conditions. The engineer will be met in the first instance with the type of construction which he should recommend for adoption, and into this question enters the volume of traffic, the materials at hand and the probable permanency of the structure. In new railroad construction, especially in undeveloped fields, permanent masonry work is rarely advisable. Again the meaning of permanent work is doubtful. It is questioned by some of the correspondents whether steel structures should be considered permanent, and in view of the fact that the majority of the steel bridges constructed from 15 to 20 years ago are now being replaced, the question is worthy of consideration; but the same query will apply to the masonry work, where in the West the masonry of 20 years ago, with the exception of most important structures, is now being either torn out and replaced or enlarged and strengthened with concrete.

A comparison should be made between the cost of a permanent structure and the capital to be invested to provide for the construction and maintenance forever of a temporary structure. To ascertain this we must consider a sum which is made up of the initial cost of the temporary structure, to be expended at the present time, plus an amount which at current rates of interest compounded will at certain recurring intervals of years, representing the life of the temporary structure, provide an amount necessary to rebuild it whenever it may be worn out. [A formula is given but not reprinted here.]

In conclusion, your committee in its next report hopes to amplify and enter more into details upon the subjects reviewed in this preliminary report, and to be guided by the result of the discussion which it is hoped this report may bring forth.

(4.) The division of design has been deferred until the next report, at which it is our intention to consider a series of typical designs and methods of construction with, if practicable, the reasons entering into the adoption of the various types, it being the design of the committee that the subject matter of this report be thoroughly digested and criticised before entering into the final field of design and construction.

The committee is indebted to Mr. W. H. Moore, of the New York, New Haven & Hartford Railroad, for valuable information. Of this committee Mr. W. L. Breckinridge, Chicago, Burlington & Quincy Railroad, is Chairman.

The Robins Conveying Belt.

In the *Railroad Gazette* of May 15, 1896, page 344, there was given an extract from a valuable paper by Mr. Thomas Robins, Jr., presented at the February meeting of the American Institute of Mining Engineers, subject, "Conveying Belts and Their Uses." The paper noticeably quickened the interest in the subject of conveying materials by belt. Mr. Robins had been experimenting with belt conveyors for six years, and he gave practical rules for calculating the capacity of belt conveyors. In these calculations he assumed that the load covered half the total width of the belt and that the depth in the center equaled one-fourth of the width, the load taking the form of an inverted triangle. This shaping of the belt surface is indicated in the illustration of idlers, shown herewith in Fig. 3. With this arrangement of belt, coal and similar materials can readily be carried up an incline of six inches to the foot.

Soon after the publication of the paper referred to the Robins Conveying Belt Company, Park Row Building, New York, was organized and its patented conveyors are now in successful use in many places, prominent examples being plants in the new purifier house of the New Amsterdam Gas Company, Long Island City; the National Lead Co.'s works, Brooklyn; Jones & Laughlin's plant, Pittsburgh; the Fortieth street power plant of the South Side Elevated Railroad, Chicago; the Chicago Edison Co.'s plant, Chicago, and the Chandler Coal Dock, San Francisco.

Illustrated herewith is a coal conveying plant recently put in at Cape Breton, at the dock of the Dominion Coal Company. The plant is shown in general elevation and in sections in Fig. 1, and is said to have the largest coal conveyor in the world. It is now in full operation. Vessels were formerly loaded from railroad cars running on a two-level system of standard gage double track, the arrangement of which is plain from the illustration. After emptying the cars on the upper level they were lowered by a drop table invented by Mr. Hiram Donkin, resident manager of the coal company, and returned by gravity to the shore end of the dock. This system worked well and rapidly when there was a full supply of coal in the cars, but it was expensive. Placing a pocket above the pier was also unsatisfactory, and an order was given to the Robins Conveying Belt Company, who designed and completed the present installation. The gravity system of car delivery is retained intact.

There is storage for 10,000 tons of coal in bins under the railroad at the shore end of the dock and means for carrying the coal from the storage and delivering it simultaneously into three or four hatches of a vessel lying alongside the dock. There are two large belt conveyors, the first of which runs through a tunnel under the storage bins, then rises about 25 ft., where it delivers to the second conveyor. The coal is then carried 35 ft. higher, which brings it to a point 30 ft. above the track level of the dock. It is then carried the entire length of the dock, unloading devices being set at three or four points by means of which a part of the coal on the belt can be deflected into chutes which run down to the collier's hatches.

The regular working capacity of the conveyors is 750 tons an hour, and this quantity of coal can be carried 1,060 ft., and delivered into a vessel without interfering in any way with the former car system, which, as may be seen from the illustration, can be operated at the same time if desired. It is estimated that the total cost of loading the coal by this conveyor, including interest, depreciation, power and labor, is considerably less than one-fourth of a cent a ton.

One of these conveyors was successfully used in excavating for the new power plant of the New York Gas and Electric Light, Heat and Power Co., at 38th street and the East River, New York city. Earth, stone and old foundations were removed at the rate of over 1,000 yards a day, 30,000 yards being handled in the month of January. This type of conveyor has been found very serviceable where steam shovel or dredge work is being done, and is now being widely used for grading and filling on railroad work.

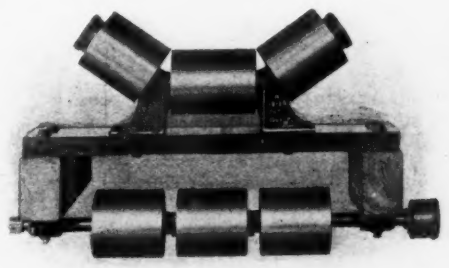


Fig. 3.—Idlers for Robins Conveying Belt.

Coal conveying and stocking plants have recently been put in at the power plants of the Delaware, Lackawanna & Western Railroad at Scranton, Pa., and at Hoboken, N. J. The conveyors there used have the delivery chute arranged to travel the length of the coal storage bin above the boilers and thus evenly distribute the coal delivered by the belt. With this arrangement the conveyor belt is made to pass over one pulley and under another in the trip carriage, thus delivering its load and propelling the carriage back and forth. A system of counterbalanced "trips" and friction wheels automatically reverses the motion of the carriage. One of these arrangements, as used at Scranton, is shown in Fig. 2. A complete set of straight and troughing idlers is shown in Fig. 3. The Scranton plant has now been working about six weeks.

The belts have a heavy rubber covering that is thicker at the middle of the belt than at its sides. The Robins Company rightly regard the idlers as an important feature of such equipment and never supply belts except to run over idlers of their own make. These idlers are in themselves an interesting bit of work. They are made in many forms, the most important, shown as troughing idlers, being used to support the loaded belt. They consist of three cast-iron pulleys running on hollow steel shafts which are held in two cast-iron brackets. They are lubricated by forcing grease into the shafts with compressor grease cups. Holes are drilled in the shafts, through which the grease works under the hub of the pulley, and each grease cup holds nearly a pound of grease, which is sufficient for several months' constant running. The cups have fine-threaded caps, one-sixth of a turn a day on the cap giving ample lubrication in the most exposed and constant work.

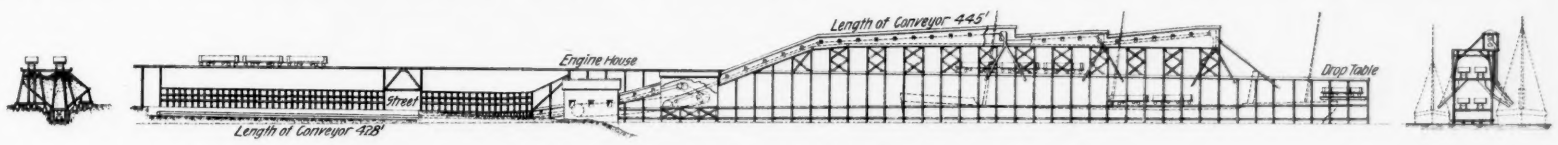


Fig. 1.—The Dominion Coal Co.'s Dock, With Robins Belt Conveyor—Cape Breton.

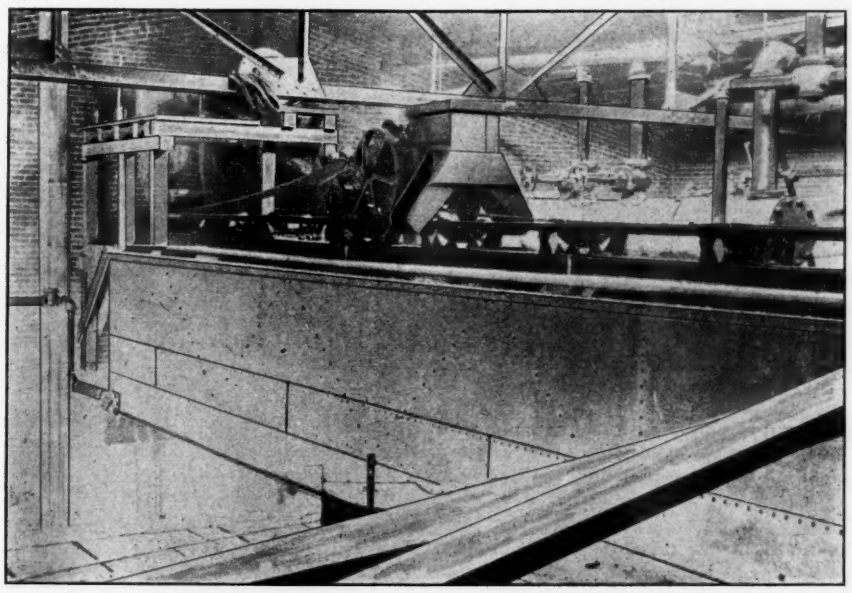


Fig. 2.—A Robins Coal Conveyor at Scranton, Pa.—D. L. & W. Railroad.

TECHNICAL.

Manufacturing and Business.

H. C. Johnstone, formerly Manager of the Ohio Coal Co., St. Paul, Minn., is now with F. A. Lester & Co., Old Colony Building, Chicago.

P. H. Wilhelm, who for three years has been Southern representative of the Railroad Supply Co., has resigned. His present address is Victoria Hotel, Chicago.

G. W. Cox has been appointed assistant to the General Manager of the Southern Car & Foundry Co., Birmingham, Ala. Formerly Mr. Cox was with the St. Charles Car Co., and more recently he was in the railroad supply business at St. Louis, Mo.

W. T. Simpson has resigned as Traveling Engineer of the Grand Trunk, to become the traveling representative of the Michigan Lubricator Co. Mr. Simpson has been with the Grand Trunk for 31 years and is the inventor of the "Michigan" driver brake retainer.

Edward J. Etting, Manufacturers' Agent, Land Title Building, Philadelphia, Pa., has opened an office in New York City, at 39 Cortlandt street. Mr. Etting represents the following concerns: Standard Pneumatic Tool Co., Chicago; Whiting Foundry Equipment Co., Chicago; Henry E. Pridmore, Chicago; Maryland Car Wheel Works, Baltimore; The Barnard & Leas Mfg. Co., Moline, Ill., and Union Mining Co., Mt. Savage, Md.

The O. M. Edwards Co., Syracuse, N. Y., maker of the Edwards window fixtures, vestibule platform trap doors and other specialties, will exhibit the several devices at the Auditorium Hotel, Chicago, March 18, 19 and 20. The dates and location were selected partly because of the monthly meeting of the Western Railway Club, which will be held at that hotel March 19. A similar exhibition was held at the Southern Hotel, St. Louis, March 8 and 9, and at the Terminal Hotel, in the same city, March 11 and 12.

Iron and Steel.

The Chicago, St. Paul & Mineapolis & Omaha have placed a contract for 36 bridges with the American Bridge Company.

The Navy Department wants new bids, until noon, April 4, for building protected cruiser No. 20, the St. Louis.

The Craig Rolling Mills Co. has been incorporated in New Jersey with a capital stock of $2,500,000. The incorporators are: H. S. Gould, John I. Billings and K. K. McLaren.

The Chicago, Rock Island & Pacific has placed an order for about 25,000 tons of rails to be used on the El Paso extension. The contract is said to have been let to the Illinois Steel Co. at $26 per ton.

The National Bureau of Standards.

The act providing for a Bureau of Standard Weights and Measures was passed in the last hours of Congress and has become a law. The nature and purpose of this excellent measure were described in our issues of Dec. 28 and March 8. Mr. S. W. Stratton, who has been active in promoting the bill, will be the first head of the Bureau, which is under the Treasury Department. He is 39 years old, a graduate of the University of Illinois, was one of the faculty of that institution, and is now connected with the University of Chicago. He is reputed to be a man of fine attainments in physics and applied science, and is a man of undoubted zeal and force.

The Brooklyn Bridge Terminals.

Last week, at a meeting of the Chamber of Commerce in New York City, Mr. Orr, President of the Rapid Transit Commission, offered a resolution providing for the appointment of a committee of three to look into the situation at the terminals of the New York and Brooklyn Bridge. In offering the resolution he told something of his own experiences and observations which could hardly magnify the danger and discomfort of the situation. We know of nothing in the country so bad as the New York end of that bridge during crowded hours. A committee was appointed, consisting of Mr. Hewitt and Mr. Schieren, former Mayors of New York and Brooklyn, and of Mr. John Claflin. These gentlemen are authorized to get expert assistance in their investigation.

Automatic Block Signals on the Baltimore & Ohio.

It is reported that the Baltimore & Ohio is to equip its Pittsburgh Division with automatic block signals; but we understand that the company has not yet decided what style of signal to use. The Pittsburgh Division extends from Pittsburgh, Pa., to Cumberland, Md., 150 miles.

Block Signals on the Reading.

The Philadelphia & Reading Railway has contracted with the Hall Signal Company for automatic block signals on the line from Reading to Harrisburg, 54 miles. On the line between Harrisburg and Shippensburg, where manual block signals are used, the company is to put up 15 block signal cabins.

THE SCRAP HEAP.

Notes.

The Toledo, St. Louis & Western has increased the pay of enginemen and some of its shopmen.

Between 200 and 300 boilermakers and other workmen in the shops of the Burlington, Cedar Rapids & Northern, at Cedar Rapids, struck, on March 5, against the introduction of the piece work system.

A float of the Long Island Railroad, carrying 17 cars of coal, capsized in the East River off Grand street, New York City, on the morning of March 12, and the cars, with their contents, sank. The cause of the disaster is obscure, but it is thought to have been due to a collision.

A press despatch from Cleveland says that the Erie and the Cleveland, Cincinnati, Chicago & St. Louis have agreed to make common and joint use of the tracks of the two companies between Marion and Galion, Ohio, 20 miles. The single tracks of the respective roads will be used together as a double track line and thus relieve a considerable congestion of traffic.

Commissioner W. P. Trickett, of the Kansas City Transportation Bureau, Chairman of the Committee on Railroad Transportation of the National Board of Trade, has written to the Presidents of the principal railroads suggesting a conference with representatives of various commercial bodies, with a view to reaching an agreement for the promotion of legislation for the regulation of interstate commerce.

Traffic Notes.

William Steinborn and James Adler, ticket brokers, were arrested at Chicago, March 5, on a charge of forging passes. The police say they have 30 cases against the accused.

The United States District Court, at Cleveland, Ohio, has declared unconstitutional the ordinance passed by the City Council of that city two years ago, fixing street car fares at 3 cents.

The Atchison, Topeka & Santa Fe has taken a large party of members of the Commercial Club of Chicago, with members of similar organizations from other cities, on an excursion to the Pacific Coast. The excursion will occupy 23 days.

Press despatches from California indicate a severe scarcity of refrigerator cars. One statement is to the effect that fruit shippers want 500 cars a day more than are furnished. In consequence of rains in February the fruit shippers want to send their oranges eastward all at once and the facilities of the railroads are unequal to the emergency. Chicago despatches indicate that the demands of the California fruit shippers have made a shortage in refrigerator cars at that city.

For the inauguration ceremonies at Washington, on March 4, the Baltimore & Ohio took 49,780 passengers to Washington, or nearly 10,000 more than the estimates of the Inaugural Committee for that road. The figures for the Pennsylvania road have not been given out, but the Committee estimate that, including troops, 145,000 visitors were in the city. Steamers brought in over 10,000 people, and it is said that 42,000 round-trip local tickets were sold by the railroads in Baltimore alone. These estimates do not include the traffic of the suburban electric roads for the street railway traffic.

From a statement made in the newspapers by President Hall, of the New York, New Haven & Hartford, it appears that the recent shipment of a large quantity of grain from the Lehigh Valley road over the New Haven line to Boston is but the beginning of what the company hopes to make a large and permanent export freight movement. The extensive freight terminals and deep-water wharves built by the New England road at Boston, which now have come into the possession of the New Haven, are well adapted to handling export freight, and it appears that the company has determined to make use of these facilities. A few improvements, which will cost but little, are to be made in these facilities.

Texas Oil for Locomotive Fuel.

Both the Southern Pacific and the Atchison have shipped oil from the new Texas fields to California to be tried in their oil burning locomotives. Press despatches indicate that as the supply of oil in Texas is very large these companies will introduce the use of oil-burning locomotives in that state if the oil proves to be well adapted to locomotive use.

Inspection of Accidents in England.

The British Board of Trade has appointed two assistant inspecting officers, Mr. J. P. S. Main and Mr. J. H. Armytage. Mr. Main has served as Locomotive Inspector and Superintendent on the Glasgow & Southwestern, the Great Central and the Australian Government railroads. Mr. Armytage, who was for three years in the London & Northwestern locomotove works, at Crewe, has had several years' experience in the train service department of the Great Northern. In 1899 that company sent him to America to report on railroad working. These new inspectors appear to be of a grade between the officers of the Royal Engineers, who conduct the inquiries into train accidents, and the sub-inspectors, who give their attention chiefly to deaths and injuries of employees which are not due to train accidents. The appointment of the new officers is made necessary by the requirements of the new law to promote the safety of employees, which was passed last year.

LOCOMOTIVE BUILDING.

The Kanawha & Michigan has ordered five locomotives from the Baldwin Locomotive Works.

The Atchison, Topeka & Santa Fe has ordered 25 locomotives from the Baldwin Locomotive Works, in addition to the order recently placed.

The Chicago & Alton, it is reported, will soon be in the market for from 15 to 25 locomotives. We have no official information.

The Southern has ordered 35 locomotives from the Baldwin Locomotive Works.

The Anaconda Copper Co. has ordered nine compressed air locomotives from the H. K. Porter Co.

The Lake Shore & Michigan Southern is reported in the market for 50 more locomotives.

The Baltimore & Ohio is having one engine built by the Pittsburgh Locomotive & Car Works.

The Maine Central has ordered three 10-wheel passenger engines from the Schenectady Locomotive Works.

The Norfolk & Southern is having one engine built by the Baldwin Locomotive Works.

CAR BUILDING.

The Frankfort & Cincinnati will soon be in the market for 100 box cars.

The Southern Pacific is getting prices on 1,000 box and 2,000 flat cars.

The New York Central & Hudson River has ordered 600 box cars from the American Car & Foundry Co.

The Chicago, New York & Boston Refrigerator Co. will build 500 refrigerator cars.

The Cudahy Packing Co. is asking bids on 215 refrigerator cars.

The Southern Pacific has ordered 100 ballast cars of 80,000 lbs. capacity, for April delivery, from the Rodger Ballast Car Co., in addition to those ordered some time ago. The special equipment includes Westinghouse brakes, Standard couplers and Common Sense bolsters.

The Pere Marquette order with the American Car & Foundry Co., for three parlor cars and two coaches, calls for June delivery. They will measure 70 ft. long over end sills. The special equipment includes Westinghouse brakes, Fulton Iron & Engine Works' brasses, Gould couplers, Acme curtain fixtures, acetylene light, Detroit springs, Gould vestibules and McKee-Fuller wheels.

The Pennsylvania Lines West of Pittsburgh are in the market for nine combination cars and eight coaches.

The Anglo-American Refrigerator Car Co. is reported in the market for refrigerator cars.

The Choctaw, Oklahoma & Gulf order with the American Car & Foundry Co., mentioned in our issue of March 1, calls for 21 mail and baggage cars, for June and July delivery. They will measure 65 ft. long. The special equipment includes Lawley brake-beams, Westinghouse air-brakes and brake adjusters, Tower couplers, Pantasote curtain material, Pintsch lights, Gould platforms, Scott springs, Standard steel-tired wheels, and Hale & Kilburn seats.

The Chicago & Western Indiana is reported in the market for a few cars.

The Guayaquil & Quito, of Ecuador, has ordered nine freight cars from the Jackson & Sharp Co.

The Michigan Ammonia Works, Detroit, have ordered three cars from the American Car & Foundry Co. They will be built at Milton.

BRIDGE BUILDING.

CALGARY, N. W. T.—The Canadian Pacific will, next summer, build a subway here.

CAMBRIDGE, MASS.—The Boston & Maine will build a bridge over the tracks at Prison Point and Austin streets to abolish the grade crossing. The plans show a plate girder structure 2,370 ft. long and 50 ft. wide, with a walk 10 ft. wide on one side.

City Engineer Hastings has submitted a report, with plans and probable cost, of abolishing 13 grade crossings in Cambridge.

CHARLOTTE, S. C.—Mecklenburg and Lincoln Counties contemplate building a joint bridge over Catawba River.

CHICAGO, ILL.—The Board of Trustees of the Sanitary District of Chicago want separate bids, on May 8, for building the superstructure and the substructure of a bridge over the Chicago River at Randolph street. It is to be a Scherzer rolling liftbridge. Alex. J. Jones, President of the Board.

COLUMBUS, NEB.—It is reported that the Union Pacific will build a new double-track steel bridge over Loup River, one mile west of this city.

EVANSVILLE, IND.—A plate girder bridge of two 70-ft. spans will be built over Pigeon Creek, on Franklin street. James D. Saunders, City Engineer.

FORT COULONGE, QUE.—An interprovincial bridge between this place and Gower Point is being advocated. The Dominion Government will be asked to grant $40,000 and the Ontario and Quebec governments $20,000 each.

GRAND FORKS, N. DAK.—Sealed proposals will be received at the office of County Auditor in Grand Forks, N. Dak., until April 2, for any or all bridges to be built by the county during the year 1901. Wm. Ackerman, Cunty Auditor.

GLOUCESTER CITY, N. J.—The Camden & Woodbury Trolley Co. will build an iron drawbridge at Big Timber Creek, replacing the present structure.

HUNTSVILLE, ONT.—A steel bridge, costing about $10,000, will be built over the Muskoka River.

KANSAS CITY, MO.—A bridge, to cost about $175,000, according to report, will be built over the Missouri River at Kansas City for the Kansas City & St. Joseph electric railroad.

LANSING, MICH.—Montrose Township proposes to build a $10,000 bridge over Flint River.

LOWELL, MASS.—It is reported that a steel bridge could be built in place of the present Pawtucket bridge over Merrimack River for $60,000, or a stone bridge at about $100,000.

MCKEES ROCKS, PA.—It is reported that the Pittsburgh & Lake Erie contemplates building a bridge at Island avenue and O'Donovan streets.

MADRID, SPAIN.—According to reports from Madrid, the office of Public Works at Madrid will consider bids for a viaduct at Pino over the Duro on the line from Tonfria to that between Salamanca and Fermoselle in the Province of Zamora. The probable cost is about $80,000.

MEMPHIS, TENN.—Bids are wanted, March 21, for a bridge over Hatchie River in the Sixth District. W. W. Barksdale, Superintendent of Bridges.

MEXICO, MO.—The Chicago & Alton and the Wabash railroads contemplate building a viaduct at Clark avenue.

NEWPORT NEWS, VA.—The Alabama Bridge & Iron Co. will build the viaduct over the Chesapeake & Ohio Ry. tracks at 28th street, Newport News. This will require two spans 153 ft. long, seven spans 30 ft. long, one span 66 ft. long, 10 spans 31 ft. long and one span 66 ft. long. The viaduct will have a 36-ft. clear roadway and two 10-ft. sidewalks.

NEW BRUNSWICK, N. J.—Work of elevating the Pennsylvania R. R. tracks through New Brunswick will probably be begun this year.

NEW YORK, N. Y.—The Aldermanic Committee on Bridges & Tunnels has taken up for consideration the matter of the Vernon avenue bridge over Newtown Creek. The engineers' estimate for a high level bridge is $644,000.

The Department of Bridges received six bids for building the tower foundations in Brooklyn for Bridge No. 3. The bidders were: Williams & Gerstle, Rogers, McMullen & McBean, Liebman & Galagan, Bernard Rolf, Ryan, Parker & Moran and Joseph Mendlor. The awards will not be announced for several days.

OAKLAND, CAL.—Plans are reported made for a bridge over Lake Merritt, at Fourteenth street at a cost of about $75,000. T. W. Morgan, Engineer.

OTTAWA, ILL.—At a recent election a bond issue was

authorized for a bridge across the Vermilion River at Kirkpatrick's Ford, Eagle Township.

PITTSBURGH, PA.—The new Liberty street bridge to be built for the Pennsylvania R. R., at Pittsburgh, Pa., will be furnished by the American Bridge Co.

The contract for the South Tenth street bridge is reported let to the Nelson Dash Buchannin Company to build a structure 64 ft. wide.

QUEBEC, QUE.—An iron bridge will be buil by the City Council to replace Bickell's bridge. Probable cost, $40,000.

RUMFORD FALLS, ME.—The contract for building a Melan arch bridge of two 80-ft. spans, 37.67 ft. wide, over the Power Canal at Hartford street, has been let to O'Hern & Berrigan, of New York. Chas. A. Mixer, M. Am. Soc. C. E., Engineer; Melan Arch Construction Co., New York, Designing Engineers.

ST. THOMAS, ONT.—It is reported that the city is about to spend $20,000 on a new steel bridge to replace the structure called Wilson bridge, on the road to Port Stanley.

SALT LAKE, UTAH.—The Rio Grande Western has let contracts for the masonry work for the new bridges to the N. P. Glann Construction Co., of Chicago. It includes the abutments for 73 bridges on the main line, all of which will be of concrete.

SHERBROOKE, N. DAK.—The Board of Commissioners of Steele County want bids, until April 1, for a number of bridges, to be of steel piling. T. S. Hunt, County Auditor.

SPRINGFIELD, MO.—The city has voted to issue $35,000 bonds for a subway and bridge at the yards of the St. Louis & San Francisco R. R.

SYRACUSE, N. Y.—A bill has been introduced in the State Senate, appropriating $32,500 for the new hoist bridge over the Oswego Canal at North Salina street, to be built under the direction of the Superintendent of Public Works.

TOLEDO, OHIO.—According to report, the Lake Shore & Michigan Southern will rebuild its bridge over Maumee River.

VICKSBURG, MISS.—Bids will probably be wanted, about May 1, for two bridges, about 400 ft. long, and for two bridges, 80 ft. long, to be used on the new road to the Military Park. Address Wm. T. Rigby, Acting Chairman of the Commissioners.

VICTORIA, B. C.—W. S. Gore, Deputy Commissioner of Lands & Works, is receiving tenders for a bridge across the Somas River, near Alberni.

WAREHAM, MASS.—Officers of the towns of Wareham and Marion, and the New Bedford & Onset Street Ry. are considering building a steel bridge over Weweantitt River, at a cost of $12,000.

WASHINGTON, D. C.—Congress, before adjournment, appropriated $50,000 for the completion of the Massachusetts avenue bridge across Rock Creek, and $75,000 toward the construction of a bridge across Rock Creek on Connecticut avenue.

The appropriation for the Memorial bridge across the Potomac to Arlington, failed to pass Congress before adjournment.

Other Structures.

BUFFALO, N. Y.—The foundry of the New York Central Car Wheel Works was destroyed by fire, March 6, causing a loss of about $100,000.

The International Traction Company's machine shop, located at Cold Springs, was destroyed by fire March 4, causing a loss of about $50,000. The building was 200 ft. long and 30 ft. wide.

DAYTON, OHIO.—The storage warehouse and annealing room of the Dayton Malleable Iron Co., were burned Feb. 28, causing a loss of about $25,000.

DULUTH, MINN.—Reports state that the Northwestern Fuel Co., of Duluth, has recently bought a large tract on the harbor front where a large coal receiving and storage dock will be built.

LOS ANGELES, CAL.—It is reported that the present shops of the Southern Pacific are to be removed and new shops built in East Los Angeles.

MCKEESPORT, PA.—Bids are wanted by the Pittsburgh, McKeesport & Connellsville Ry. Co. for building a car shop at McKeesport. Address M. R. McAdoo, First National Bank Bldg., Pittsburgh.

MARION, OHIO.—The Hocking Valley is considering the advisability of building a new passenger station in Marion.

NEW YORK, N. Y.—Fire on the night of March 10 completely destroyed the brick station and office building of the New York Division of the New York, New Haven & Hartford at 133rd street and Willis avenue, near the Harlem River. The building was three stories high, 40 x 300 ft.

NORWALK, OHIO.—It is reported that the Wheeling & Lake Erie has plans made for new shops in Norwalk.

PITTSBURGH, PA.—The Eclipse Manufacturing Co. is applying for incorporation in Pennsylvania, with a capital stock of $50,000, to build a plant to make iron and steel forgings, at Thirty-eighth and Sassafras streets, Pittsburgh. Among those interested are: Harry L. Borland, Wm. E. Wagner, R. B. Ewing.

READING, PA.—The Philadelphia & Reading has let a contract to Geo. W. Baird & Co., of Reading, for building a powerhouse and boiler house to be erected in connection with the locomotive repair shop, now building. Both structures will be of brick. The powerhouse will be 50 x 175 ft., and the boiler house 60 x 175 ft.

SPOKANE, WASH.—The Great Northern has let the contract for the construction of a passenger station in this city to cost $150,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xii.)

North-West Railway Club.

At the meeting in St. Paul, on March 13, discussion was continued on Mr. Burch's paper, "Electric Traction for Heavy Railway Service." A paper was presented by Mr. Spencer Otis, M. Am. Soc. M. E., on "The Future Simple Locomotive."

The Engineers' Club of Philadelphia.

At the regular meeting of the Club, to be held on Saturday evening of this week, Mr. J. C. Trautwine, Jr., will present Part V of his paper on "The Queen Lane Division of the Water Works at Philadelphia."

At the meeting on March 2, Mr. F. Lynwood Garrison gave "Some Notes in China by an American Engineer," in which he described, with the aid of lantern illustrations, some observations which he made during a recent visit to China. He also described the principal topographical features of the country, and its mineral and agricultural resources were pointed out.

Western Railway Club.

A meeting of the Western Railway Club will be held Tuesday afternoon, March 19, at the Auditorium Hotel, Chicago. Mr. G. W. Scott, of the Pullman Co., will read a paper on "A System of Steel Framing for Freight Cars." Mr. M. H. Wickhorst, of the Chicago, Burlington & Quincy, will open a discussion on the specifications for steel axles proposed by the American Section of the International Association for Testing Materials. On the day of the meeting, the dynamometer car owned jointly by the Illinois Central and the University of Illinois will be set out at the foot of Van Buren street, and will be open for inspection from 10 a. m. to 5:30 p. m.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. R. F. Kennedy, President of the Jacksonville & St. Louis Railway, died recently at his home in Philadelphia.

—Mr. Charles Kennedy, who underwent a serious surgical operation two weeks ago, died at Chicago, Ill., March 11. Mr. Kennedy was Assistant General Passenger Agent of the Chicago, Rock Island & Pacific.

—Mr. H. E. Farrell, the new Freight Traffic Manager of the St. Louis Southwestern Railway, was born at Detroit, Mich., Oct. 11, 1864. He began his railroad career as a messenger boy in 1878 on the Michigan Central and subsequently served as Clerk on the Detroit, Grand Haven & Milwaukee, and on the Grand Trunk, until 1883. From then, until 1896, when he became Assistant General Freight Agent of the St. Louis Southwestern, he was connected with several roads as Commercial Agent and in other capacities. In September, 1898, he became General Freight Agent of the St. Louis Southwestern Railway of Texas, at Tyler, and served the company in this capacity until Feb. 28, this year, when he took his present position.

—Rear Admiral Francis T. Bowles, U. S. N., has taken active charge of the Bureau of Construction and Repair of the Navy Department, succeeding Rear Admiral Hichborn, and the following changes have been made among the officers of that corps: Naval Constructor W. L. Capps, from duty in the Bureau of Construction to the Navy Yard, New York, succeeding Admiral Bowles; Assistant Naval Constructor R. M. Watt, from Elizabethport to New York, as Assistant to Constructor Capps; Assistant Naval Constructor Henry G. Smith, from the Navy Yard, New York, to duty in the Bureau of Construction and Repair; Naval Constructor J. J. Woodward, who was Chief Assistant to Admiral Hichborn, is assigned to duty as a member of the Board of Inspection and Survey.

—Mr. E. A. Burrill, Superintendent of the Illinois Southern Railway, was, from 1876 to 1878, a fireman on the Missouri Pacific, then for one year Foreman of the Yard of the Joint Lines at St. Louis. The following three years he served as Clerk in the Freight Office of the St. Louis Bridge Company, now the Terminal Railroad Association. In June, 1882, he was appointed Contracting Freight Agent of the Great Eastern line, and in October, 1884, Live Stock Agent of the National Stock Yards. Then, in August, 1885, he was made Chief Clerk of the Maintenance of Way Department on the Mobile & Ohio, later becoming Chief Clerk to the Superintendent. From 1893 until February this year, when Mr. Burrill was appointed Superintendent of the Illinois Southern, he was General Freight and Passenger Agent of the Centralia & Chester (Illinois Southern).

—Mr. George H. Turner, General Manager of the Midland Railway of England for the past nine years, has resigned. Mr. Turner was born in Bridgewater, and when about 12 years old was employed as a clerk on the Bristol & Exeter. In 1853, he entered the Midland Company's service as goods clerk at Bristol, and was gradually promoted, until in 1878 he was transferred to Derby as chief goods canvasser. In 1885 he became goods manager for the Glasgow & Southwestern, returning to the Midland two years later as chief goods manager. In 1892, he was made General Manager. For the year 1900, Mr. Turner was Chairman of the General Managers' Conference, and about the same time was elected Chairman of the Board of Managers of the Railway Benevolent Institution. Mr. Turner is Lieutenant-Colonel of the Headquarters Staff Corps of Railway Engineers.

—Mr. E. H. Fitzhugh, who has resigned as Vice-President and General Manager of the Central Vermont, is going, it is said, to the Southern Pacific. Mr. Fitzhugh was born at Montgomery, Mo., Feb. 1, 1853. He entered the service of the St. Louis, Kansas City & Northern in 1873, in the car mileage office. This line was afterwards absorbed by the Wabash and Mr. Fitzhugh became Chief Clerk to the Superintendent of the Western Division, which position he held until 1889, when he was appointed Master of Transportation at Moberly, Mo. When Mr. Hays became General Manager of the Grand Trunk Mr. Fitzhugh went to Montreal as his Executive Secretary. On July 15, 1896, he was appointed Superintendent of the Middle Division of the road, with office at Toronto. Upon the reorganization of the Central Vermont, in May, 1899, Mr. Fitzhugh was elected Vice-President and General Manager, also a Director.

—Prof. Samuel W. Stratton, Chief of the Bureau of Weights and Measures of the Coast and Geodetic Survey, was nominated by the President on March 9, and at once confirmed by the Senate, as Director of the new National Bureau of Standards which has just been established by Congress. Prof. Stratton was born in Litchfield, Ill., in 1862, and graduated from the University of Illinois as a Mechanical Engineer in 1884. In the Fall of that year he was appointed an Instructor in Mathematics and Physics at the University of Illinois, and was afterward promoted to be Assistant Professor, and still later Professor of Physics and Electrical Engineering. Being the first Professor of Electrical Engineering at the University of Illinois he organized the laboratories, selected the apparatus and started the course in that department. In the Fall of 1892 Prof. Stratton went to the University of Chicago, where, in 1897, he became full Professor of Physics. At the University of Chicago Prof. Stratton organized the laboratories of the Department of Physics, designing and superintending the equipment of the Ryerson Physical Laboratory upon its completion. He has also done much expert work as a Consulting Electrical and Mechanical Engineer in Chicago and elsewhere. During the Spanish war he served as a lieutenant in the Navy on several ships in Cuban waters, and has for years taken an active interest in the Illinois Naval Reserve, of which he is an officer. In the Fall of 1899 Prof. Stratton was appointed Chief of the Bureau of Weights and Measures under the Coast and Geodetic Survey and was given leave by the University of Chicago to accept the position, which he did temporarily, with the view of promoting the legislation which resulted in the establishment of the bureau, in which he is deeply interested. The appointment as Director came to him as a great surprise, not having been sought for or expected by him. Prof. Stratton is known as a man of ability and energy with great capacity for work. He is well equipped to organize and manage successfully the new bureau and it should be one of the best scientific departments of the Government, as well as one of great importance to commercial interests.

—Mr. Onward Bates has resigned as Engineer and Superintendent of Bridges and Buildings of the Chicago, Milwaukee & St. Paul, and will open an office in Chicago as Engineer and Contractor. Mr. Bates has had a wide experience in bridge work. He was born Feb. 24, 1850, in St. Charles County, Mo., and when 15 years old entered the Fulton Iron Works at St. Louis, Mo., and learned the trade of pattern making. From August, 1868, to July, 1869, he was draftsman and inspector of iron work on the St. Charles bridge over the Missouri River, and for two years following he was foreman in charge of building iron caissons for piers of the Eads Bridge at St. Louis. He then attended Rensselaer Polytechnic Institute for the two years ending June, 1873. Since then he has successively held the following positions: Assistant Engineer of the Baltimore Bridge Company, July, 1873, to November, 1874; Assistant Engineer and Inspector of Iron Bridges and Trestles of the Cincinnati Southern to June, 1877; Inspector of Iron Bridges, Chicago, Milwaukee & St. Paul, to March, 1878; Australian Representative of the Edge Moor Iron Company, to September, 1881; President of the Pittsburgh Bridge Company, to March, 1884; Assistant to the late C. Shaler Smith in practice as Consulting Engineer until April, 1886; one year engaged in gold mining; with Edge Moor Bridge Works to Feb. 1, 1888. Since that time he has been Engineer and Superintendent of Bridges and Buildings of the Chicago, Milwaukee & St. Paul. The St. Paul is peculiar in its policy in doing work with its own employees, and so the work of the bridge department has been done by day labor. In this way Mr. Bates has been at the head of a large working organization, with a pay roll at times exceeding $100,000 a month. In the period of 13 years that Mr. Bates has been with the St. Paul, the system has grown from 5,700 to 6,500 miles, and there have been built more than 11 miles of iron and steel bridges. The culverts built made it possible to replace 44 miles of wooden bridges with earth embankments. Mr. Bates holds an honorary degree of Civil Engineer from the University of Wisconsin and is a member of the American Society of Civil Engineers, Western Society of Engineers, Institution of Civil Engineers, American Railway Engineering and Maintenance of Way Association and other technical societies.

ELECTIONS AND APPOINTMENTS.

Austin & Northwestern.—G. Waldo has been appointed General Freight and Passenger Agent, with headquarters at Austin, Texas, succeeding the late L. S. Palfrey.

Brockville, Westport & Sault Ste. Marie.—Owing to ill health, J. Mooney has been relieved of the duties of Superintendent, and E. A. Geiger has been appointed Superintendent, General Freight Agent and Treasurer. Mr. Mooney was appointed General Passenger Agent, and W. A. Gogo becomes Auditor.

Brunswick & Birmingham.—J. A. McDuffie has been appointed General Manager. (See R. R. Construction column.)

Canadian Pacific.—The title of Capt. J. C. Gore has been changed from Port Captain to Assistant Superintendent of the Columbia & Kootenay Steamers, reporting to Superintendent W. Downie.

Central Vermont.—R. S. Logan has been elected Vice-President and General Manager, with headquarters at St. Albans, Vt., succeeding E. H. Fitzhugh, resigned. Ira W. Gantt has been appointed General Freight Agent, with headquarters at St. Albans, Vt., succeeding J. E. Dalrymple, resigned, effective March 15. (See Grand Trunk.)

Chicago, Milwaukee & St. Paul.—C. F. Loweth has been appointed Engineer and Superintendent of Bridges and Buildings, succeeding Onward Bates, resigned, to engage in business for himself, effective March 18. A. H. Thomas has been appointed Master Mechanic, with headquarters at Milwaukee, Wis.

Chicago, Rock Island & Texas.—T. B. S. Brasted has been appointed General Agent for the Freight and Passenger departments, with headquarters at El Paso, Tex.

Choctaw, Oklahoma & Gulf.—C. E. Mandeville, Car Accountant, will also assume the duties of Superintendent of Car Service.

Duluth, South Shore & Atlantic.—T. H. Larke, Assistant General Passenger Agent, with headquarters at Duluth, Minn., has resigned.

Eastern of Minnesota.—J. C. Eden, heretofore General Freight Agent, has been appointed Traffic Manager.

Grand Trunk.—J. E. Dalrymple, heretofore General Freight Agent of the Central Vermont, has been appointed Assistant to the General Manager of the G. T., succeeding R. S. Logan, resigned, effective March 15.

Hot Springs.—J. Dickson has been elected President and General Manager.

Jacksonville & St. Louis.—H. A. Bonn has been appointed General Passenger Agent, succeeding John W. Daly, resigned.

Kansas City, Fort Scott & Memphis.—The position of Chief Engineer, held by D. Bontecou, has been abolished. J. V. Hanna has been appointed Assistant Chief Engineer, in charge of the Engineering Department, with headquarters at Kansas City, Mo. G. W. Horton, heretofore Assistant Chief Engineer, succeeds Mr. Hanna as Resident Engineer, headquarters remaining at Springfield, Mo.

Lehigh Valley—S. Higgins, Superintendent of Motive Power, with headquarters at S. Bethlehem, Pa., has resigned.

Louisville & Nashville.—C. B. Gifford, Division Master Mechanic at Birmingham, Ala., has resigned.

Missouri Pacific.—James W. Way has been appointed Consulting Engineer and H. Rohwer Chief Engineer, succeeding Mr. Way. Mr. Rohwer was heretofore Assistant Engineer. At a meeting, held March 12, F. J. Gates and W. K. Bixby were elected Directors, succeeding T. T. Eckert and the late S. H. H. Clark, respectively.

Omaha, Kansas City & Eastern.—L. F. Moore has been appointed Assistant General Freight Agent, with head-

quarters at Kansas City, Mo. The office of General Agent at Chicago is abolished.

Oregon Short Line.—D. S. Spencer has been appointed Assistant General Passenger Agent.

Philadelphia & Reading.—R. F. Reaver, Assistant General Passenger Agent, with headquarters at Philadelphia, Pa., has resigned.

Pennsylvania Company.—L. Ohliger, heretofore Superintendent at Cambridge, Ohio, of the Northwest System, has been appointed Superintendent of the Southwest System, with headquarters at Richmond, Ind., succeeding J. S. May, resigned.

St. Louis Southwestern.—R. S. Davis, heretofore General Freight Agent at St. Louis, Mo., has been appointed General Freight Agent of the St. Louis Southwestern of Texas, succeeding H. E. Farrell. The position formerly held by Mr. Davis is abolished. J. P. Park becomes Assistant General Freight Agent, with headquarters at St. Louis, Mo.

Santa Fe, Prescott & Phoenix.—Wm. H. Murphy has been appointed Secretary and Treasurer, with headquarters at 40 Moffat Block, Detroit, Mich., succeeding Lem. W. Bowen, resigned; and Wallace Fairbank becomes Assistant Secretary and Treasurer, at Prescott, Ariz., succeeding F. J. Sarmiento, resigned.

Toledo, St. Louis & Western.—J. S. Turner, Superintendent of Motive Power and Equipment, with headquarters at Frankfort, Ind., has resigned, effective March 15.

B. R. Stephens has been appointed Acting General Superintendent, during the absence of C. F. Franklin, owing to ill health.

Union Pacific.—S. Higgins, Superintendent of Motive Power of the Lehigh Valley, has been appointed Superintendent of Motive Power of the U. P., succeeding J. H. McConnell.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Adena.—The Adena Company, of Cleveland, was incorporated in Ohio, March 5, with $1,000,000 capital stock, by Clarence E. Sanders, J. P. Stark, W. M. Duncan, W. C. Boyle and W. B. Whiting, to build a steam railroad connecting Adena, in Jefferson County, with Martin's Ferry, in Belmont County. It is supposed to be a Baltimore & Ohio branch.

Baltimore & Ohio.—Surveys are reported in progress for a cut-off from Smith's Ferry, Pa., to run west about 60 miles to Canton, Ohio, which will reduce the distance between Pittsburgh and Chicago.

Bellingham Bay & Eastern.—The stockholders have voted to increase the capital stock from $100,000 to $250,000, and to issue $500,000 of bonds to complete this line to Fairhaven and Wickersham, Wash. (Construction Supplement, March 8, 1901.)

Brunswick & Birmingham.—A mortgage has been filed to the Knickerbocker Trust Co., New York, covering $6,500,000 5 per cent. bonds to run 50 years. The proceeds are to be used in building and equipping this line which is projected from Brunswick, Ga., to Birmingham, Ala., 450 miles. C. I. Bushnell, New York, is Vice-President. (Construction Supplement, March 8, 1901.)

Canada Atlantic.—The company is surveying a short cut from a point near Ottawa to Vaudreuil, to shorten the present route via Coteau and to shorten the time between Montreal and Ottawa 90 minutes.

Chicago, Kalamazoo & Saginaw.—A. F. Fausey, of Hastings, Mich., is reported to have the contract for grading the extension from Kalamazoo southeast about 10 miles to Pavilion. (Construction Supplement, March 8, 1901.)

Columbia & Montour Electric.—The Pennsylvania Steel Co. is reported to have taken a contract for rails and angle plates for this electric line from Catawissa, Pa., northeast through Bloomsburg to Berwick. M. F. D. Scanlan, of Bloomsburg, have the general contract. (Construction Supplement, March 8, 1901.)

East & West of Georgia.—Surveys are completed for this new line from Sparta, Hancock County, Ga., to run south 27 miles to Sandersville, Washington County. The maximum grades are 1 per cent. and the maximum curves 4 deg. (Construction Supplement, March 8, 1901.) W. B. Bennett, of Sparta, Ga., is President. (Official.)

Grand Trunk.—A spur about 1½ miles long will be built at Belleville, Ont., to factories, according to report.

Hervey City & Southern Electric.—Application has been made to the Supervisors of Macon County, Ill., for right of way from Decatur to the south line of the county for this proposed line from Decatur south about 40 miles via Hervey City to Shelbyville. J. W. Butram, of Shelbyville, is Vice-President.

Iowa Roads.—L. G. Everist, President of the Empire Coal Co., has let the contract for building a coal railroad from the Empire mine on Cedar Creek, near Bussey, Marion County, Iowa, to connect with the Wabash and the Chicago, Burlington & Quincy, about four miles. Building was to be begun March 15 and the road built and equipped within 60 days.

Keokuk & Western.—An officer writes that there is nothing as yet in the report of a spur at Des Moines, Iowa, to the site of the Army Post. (March 1, p. 151.)

Lake Shore Electric.—Preliminary agreements were signed by E. W. Moore, at Cleveland, Ohio, March 2, representing the Everett-Moore syndicate which controls the Cleveland & Lorain Electric and the Sandusky & Interurban, and by J. Horace Harding, representing Chas. D. Barney & Co., who control the People's Electric of Sandusky, and the Sandusky, Milan & Norwalk Electric, by which all these roads will be consolidated into one corporation known as the Lake Shore Electric. It is proposed to issue $4,000,000 of bonds and a like amount of stock, of which $1,500,000 is preferred. Mr. Harding makes the following statement:

As a result of this combination, one corporation will operate the roads from Cleveland to Sandusky, all the roads in Sandusky, and the line to Norwalk. The Sandusky interurban line will be pushed to immediate completion, and the People's Electric Ry. and the Sandusky, Milan & Norwalk will be rebuilt to the high standard of the interurban line. Traffic arrangements will be made to bring the Toledo, Fremont & Norwalk road into Sandusky, and probably the Cleveland, Elyria & Western will also be given an entrance into Sandusky over these lines. The financing of the new company has all been arranged, and the capital stock will probably amount to $4,000,000 and the bonded debt to $4,000,000, secured by a mortgage on the entire properties. The completion of this deal will give the Everett and Moore syndicate through electric railway connection between the properties in Cleveland and their recently acquired properties in Detroit. Charles D. Barney & Co. have not sold out their interests with the Cleveland parties and will become more largely interested in the entire property.

The Everett-Moore Syndicate also controls the Cleveland, Painesville & Eastern, now being built to Fairport, and the Northern Ohio Traction. (See these various companies in our Construction Supplement, March 8, 1901.)

Lakeside, Napoleon & Western.—This company has been organized at Port Clinton, Ohio, to build a railroad from Napoleon east 50 miles via Bowling Green, Fremont, Port Clinton, Lakeside and Piccolo to Marblehead.

Little Rock & Eastern.—This company was incorporated, in Arkansas, Feb. 27, with a capital stock of $75,000, to build a spur five miles long within the limits of Little Rock. Chas. M. Newton, of Little Rock, is President.

Louisiana Roads.—The Rose Hill Sugar Co. is reported to have begun building a standard gage line from its land on the bank of the Vermilion Bayou, to connect with the Iberville & Vermilion line of the Southern Pacific at Young's Switch.

Lyons & Sodus Bay.—This company was incorporated in New York, March 8, with a capital stock of $400,000, to build an electric line from Lyons, N. Y., on the New York Central, to run north about 15 miles to Sodus Bay on Lake Ontario.

Maine Central.—The directors, on March 1, authorized the President to make the necessary surveys for a line from Winthrop, Me., northeast about 13 miles to Augusta, which will shorten the line between Lewiston and Augusta.

Manitoulin & North Shore.—Messrs. Hearst & McKay are asking the Dominion Parliament permission to build branch lines in the districts of Nipissing and Algoma, and to have the company's act of incorporation amended. (Construction Supplement, March 8, 1901.)

Mason City & Fort Dodge.—An officer denies the report of a proposed extension from Lehigh, Iowa, southeast about 75 miles along the Des Moines River to Des Moines. (March 1, p. 152.)

New Brunswick Roads.—A bill is being introduced in the New Brunswick Legislature by the Hon. Wm. Tweedie, providing for a 3 per cent. guarantee on 55 per cent. of the cost of a railroad to connect the Grand Lake coal deposits with Fredericton and the Intercolonial Ry., to run from the terminus of the Central Railway at Chipman to Gibson in York, or a point at or near Penniac, on the Canada Eastern. The rate of interest on the bonds is not to exceed 3 per cent., and no part of the guarantee is to be paid until the railroad is in operation. The net proffis are to be applied to the payment of the interest on the bonds and the creation of the sinking fund. The company is to bind itself to establish on the line a plant capable of mining an average of not less than 500 tons of coal a day. The company is to pay a royalty of 10 cents per ton on all coal mined on granted lands, and 15 cents per ton on coal mined on crown lands. The road must be commenced before Jan. 1, 1902. The route suggested is by way of the villages of Gagetown and Oromocto and the parishes of Sheffield and Mangerville, entering Gibson across the Nashwaak River's mouth.

New Orleans, Natchez & Arkansas.—This company has been organized to build a railroad from Vidalia, La., north about 100 miles up the Mississippi to Lake Providence. T. C. Averill, of Cedar Rapids, Iowa, is President, and Curtis Judd, of Lynn, Mass., vice-president.

Northern Pacific.—Foley Bros., of St. Paul, according to report, have the contract for a 35-mile extension out of Oberon, N. Dak.

The company is also reported about to build a cut-off from Sims, N. Dak., to Curlew.

Ohio Northwestern.—This company was incorporated in Ohio, March 11, with a capital stock of $2,000, to build a steam or electric railroad from Fostoria northwest about 20 miles to Mungen, Wood County. The incorporators are: William D. Clark, J. M. Bever, Levi Harbaugh, John A. Bradner and H. E. Bradner.

Pennsylvania.—The Common Council of Newark, N. J., has passed the ordinance for elevating the tracks of the Pennsylvania at that city. (Construction Supplement, March 8, 1901.)

Quebec Roads.—John Sharples, V. Chateauvre and others of Quebec are asking incorporation for a railroad from the northern terminus of the Quebec bridge to the city of Quebec, and from the southern terminus of the bridge to a point on the Grand Trunk and the Drummond County at Chaudiere curve.

Fitzpatrick, Ray & Cannon, of Quebec, are applying for a charter to build a railroad from Lime Ridge, in Wolfe County, to the site of the proposed Quebec Bridge over the St. Lawrence by way of the Thames River, with power to enter the city of Quebec.

Richmond Beach.—This company was incorporated in New York, March 5, with a capital stock of $20,000, to build a steam or electric road from Arbutus Lake, on Staten Island, to the tracks of the Staten Island Rapid Transit Co., near Annadale. The directors are: William B. Rockwell, John Eliot Bowles, M. J. Wightman, Harry T. Bowles, Russell S. Foot and Frank Coenen, of New York City; Everett L. Brown, of Perth Amboy, N. J.; M. P. Andelfinger, Brooklyn, and Charles Johnson, of Seaside, S. I.

St. Louis & San Francisco.—An extension, according to report, will be built to connect the recently acquired Kansas City, Fort Scott & Memphis with this line. It will run from the terminus of the Memphis at Miami, Ind. T., either to Wyandotte or Afton, about 15 miles.

Southern.—See Houston & Texas Central under News.

Tennessee Central.—An officer confirms the statement that the company is building a branch for coal only 1½ miles long from Ozone, Tenn. The maximum curve is 6 deg. and the maximum grade 2 per cent. (March 1, p. 152.)

Toledo, Waterville & Southern.—Application has been made, through Geo. Metzger, to the Lucas (Ohio) County Commissioners for right of way between Maumee and Waterville, on this line from Toledo southwest through those towns.

Trinidad Electric.—Montreal capitalists who own this company have been notified by the British Colonial Government of the Island of Trinidad, through a cablegram to W. B. Chapman, of Montreal, that they have been granted a charter to build an electric railroad or tramway, and to erect an electric lighting plant in the city of the Port of Spain, the capital of the Island. The Trinidad Electric Co. obtained control of the existing tramway lines some time ago. Under the new charter they can spend $940,000 in the acquiring or the existing tramways and lighting plants and converting them into an electric system covering the whole of the city of Port of Spain and three adjacent suburbs. The company will be capitalized at $1,000,000. Messrs. McConnell & Bruce, the company's engineers, are preparing plans and work will be begun at once. Sir William Van Horne, Lord Strathcona, James Ross, R. B. Angus, Hon. G. A. Drummond, E. S. Clouston, A. F. Gault, T. G. Shaughnessy are reported interested.

Victoria, Vancouver & Eastern.—Wm. Mackenzie, of Mackenzie & Mann, states that work is about to be begun on the line beginning at both the Pacific coast and the Intercolonial boundary. It is to form the western end of the Canadian Northern. (Construction Supplement, March 8, 1901.)

GENERAL RAILROAD NEWS.

Cincinnati Southern.—President Samuel Spencer has submitted to the city of Cincinnati a second proposition for the renewal of the lease of this property. He offers to lease the road for 65 years from Oct. 1, 1900, at an annual rental of $1,050,000, and to pay 4 per cent. on $2,500,000 city bonds, to be issued for terminals at the rate of $500,000 yearly, beginning not later than January, 1902. (Dec. 28, 1900, p. 868.)

Cleveland, Lorain & Wheeling.—The Baltimore & Ohio has obtained control of this property through purchase of a majority of the stock. It is understood that the preferred stock outstanding, which amounts to $5,000,000 and is 5 per cent. non-cumulative, is to be replaced by 4½ per cent. bonds. The line runs from Bridgeport, Ohio, northwest 157.5 miles to Lorain, with a branch from Lester north 28 miles to Cleveland, and another branch from Martin's Ferry to Bellaire, 6.8 miles, making a total of 192.3 miles. There is $8,000,000 of common stock outstanding, and a funded debt of $6,843,000. There are also car trust bonds outstanding to the par value of $174,476.

Concord & Montreal.—This line of the Boston & Maine is applying for permission to merge into itself the following proprietary companies: Profile & Franconia Notch, 13½ miles, $234,600 capital stock; Lake Huron, 26 miles, $329,800 capital stock; Tilton & Belmont, 4 miles, $47,200 capital stock; Suncook Valley Extension, 4½ miles, $77,000 capital stock.

Great Northern.—The stockholders, so it is believed, will soon be permitted to subscribe to a new issue of stock, probably in connection with the Crows Nest coal extension and properties.

Grand Trunk.—The Railway Committee of the Canadian House of Commons has passed a bill authorizing the lease of the Cincinnati, Jackson & Mackinaw, for 99 years by this company. (Feb. 22, p. 136.)

Hot Springs.—This line, which runs from Hot Springs, Ark., to Malvern, 22 miles, has been bought by Col. Joseph Dickson, of St. Louis, in behalf, it is said, of interests connected with the Missouri Pacific.

Houston & Texas Central.—The Texas State Senate has passed a bill authorizing this company to buy the Austin & Northwestern, the Central Texas & Northwestern, and other small roads, which it now controls. The bill also provides for an extension of the Austin & Northwestern from Burnett to Lampasas, 50 miles, within the next few years.

Maryland & Pennsylvania.—Alexander Brown & Co., of Baltimore, Md., are offering the new first mortgage 4 per cent. 50-year gold bonds at 95 and accrued interest, payable March 18, 1901. The company is successor to the York Southern and Baltimore & Lehigh. (Feb. 22, p. 136.)

Missouri Midland.—This line, extending from Columbia to McVaine, Mo., 8.87 miles, has been bought, according to report, in the interest of the Missouri, Kansas & Texas, with which it connects at McVaine.

New Orleans & Western.—This property was sold at public auction at New Orleans, La., March 9, for $100,000, to a syndicate of bondholders represented by F. J. Lisman. (Jan. 25, p. 70.)

Northern Central.—The Maryland Court of Appeals has decided in favor of the State of Maryland that the Commonwealth is not obliged to accept a lump sum of $1,500,000 in extinguishment of the annual annuity of $90,000 which the Northern Central obligated itself to pay under the act of 1850. (June 8, 1900, p. 380.)

Pennsylvania.—The stockholders, at the annual meeting, on March 12, voted to increase the capital stock by $100,000,000, and to elect the directors in four classes for one, two, three and four years respectively.

Seattle & International.—The Northern Pacific will begin about April 1, according to report, to operate this line as part of its main system instead of independently. The road is already controlled by the N. P.

Southern.—The directors, on March 8, declared a semi-annual dividend of 2 per cent. on the preferred stock, thus increasing the annual rate to 4 per cent., as against 3 per cent. in 1900, and 2 per cent. in 1899.

Southern Pacific.—The syndicate which bought this property in the interest of the Union Pacific, on March 4 paid over 50 per cent. of the purchase money through the Manhattan Bank.

Terminal Railroad Association of St. Louis.—The eleventh annual report is for the year ending Dec. 31, 1900. The gross earnings were $2,127,000 and the net earnings $1,325,000. There was an increase of nearly $39,000 because of unusual expenditures in maintenance of way, motive power and on the Eads Bridge. The total car movement across the bridge numbered 574,083 cars, of which 229,413 were loaded freight cars and 140,178 empty freight cars. The revenue per freight car was $4.92. The average load per car was 17.43 tons.

Terre Haute & Indianapolis.—The U. S. Circuit Court of Appeals for the Seventh Circuit has denied the motion for a rehearing of the case decided by it last May, affirming the order of Circuit Court Judge Woods, and directly the receiver of the T. H. & I., to pay out of the Peoria fund derived from the 30 per cent. of gross earnings due the T. H. & Peoria under the terms of the lease, the coupon due September, 1896, on the T. H. & Peoria bonds. (June 1, 1900, p. 364.)